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AMERICAN RADIO RELAY LEAGUE

MAY 1924 20¢

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THE AMERICAN RADIO RELAY LEAGUE, Inc.
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THE AMERICAN RADIO RELAY LEAGUE

The American Radio Relay League, Inc., is a national non-commercial association of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, for orderly operating, and for the practical improvement of short-wave two-way radio telegraphic communication.

It is an incorporated association without capital stock, chartered under the laws of Connecticut. Its affairs are governed by a board of Directors, elected every two years by the general membership. The officers are elected or appointed by the Directors. The League is non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its Board.

"Of, by and for the amateur," it numbers within its ranks practically every worth-while amateur in America and has a history of glorious achievement as the standard bearer in amateur affairs.

Inquiries regarding membership are solicited. Ownership of a transmitting station, while very desirable, is not a prerequisite to membership; a bona-fide interest in amateur radio is the only essential. Correspondence should be addressed to the Secretary.

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EDITORIALS
de AMERICAN RADIO RELAY LEAGUE

The New White Bill

THE radio bills that bloom in the spring are with us. Of this season's bills by far the most important is Congressman White's, which was introduced in the House on February 28th and under the number H.R.7357 was referred to the Committee on the Merchant Marine & Fisheries, where hearings were held on it during middle March. At this writing near the end of March, the bill reposes with the MM&F Sub-Committee on Radio, of which Mr. White himself is the chairman.

The new White Bill is not a modification of the existing radio law, as was Mr. White's document of last year, but would repeal the 1912 statute and supplant it with an entirely new structure. While as far as we amateurs are concerned the law of 1912 may be proving entirely satisfactory, it has many outgrown features affecting other services, so that changes in the not distant future are not only desirable from many standpoints but certain to come. Whether or not these desirable changes could be effected by a few amendments to the present law we are not sure, altho we believe they could, but the present bill wipes the slate clean and starts from scratch. In general it follows the idea of the previous White Bill, eliminating all mention of specific classes of stations or their wavelengths and so on, and instead provides an administrative scheme calculated to endure thru years of progress in the art. To accomplish this it provides that the administrative power, the Secretary of Commerce in this case, shall classify stations and make, alter and revoke regulations applicable to all stations concerning their wave lengths, apparatus, power, interference, hours of operation, etc. Thus we find nothing in the bill to say that there shall be amateurs operating on the waves below 200 meters, as is the case with present law. When stations are to be classified by the administrative power, presumably amateur stations are to be set up as one of the classes; and, being thus provided for, they would use such wavelengths and powers and hours as might from time to time be announced by regulation.

Thus there are no guarantees of existence in the bill for anybody, and we cannot feel very happy over any radio bill that does not mention us by name in such a way as to establish it clearly that there shall be amateurs. Presumably some of the other radio interests feel the same way about themselves. This is Mr. White's basic idea, however—this elimination of technical particulars that it may be desirable to change as time goes on—and it is not likely that any White Bill will appear in which exceptions are made to this fundamental concept. Furthermore, unless all particulars about a certain class of station are specified in the law (a hopeless and an undesirable thing), what happiness is there to be gained in a barren provision for one's "existence"? For instance, what is it worth to insist that the law say that amateurs shall be permitted, when regulations, changeable over night, might specify the wave band as 1 to 2 meters or around 60,000 meters, power 2 watts, quiet period 24 hours long?

No, it is clear that if some such "administrative skeleton" idea is to become law, we must be prepared to take our chances with it. First, however, we can examine it further to see that it is a good administrative scheme. *We do not believe the White Bill is.* Because men are human and not infallible, it is a dangerous bill. In its zeal to untie the hands of the Department of Commerce and permit it to make, alter and revoke regulations at will so as to keep pace with a rapidly advancing art, the bill leaves everything to the judgment of the Secretary of Commerce and is filled with expressions such as "in his judgment", "as he may deem necessary", "in his discretion", "sufficient to satisfy him", "as he may deem proper", etc. This is where the danger lies. If the present Secretary and the present admirable Chief Supervisor of Radio could remain in office always, we believe things would be wholly satisfactory, but politics dictate policies when not fixed by law, personnel changes, and under a different administration of the Department anything might happen. There is where the dielectric starts smoking, for no decision made under a grant of discretionary power can be reviewed by the courts. That means that no unjust, unfriendly, or mistaken decision could be appealed, and that the White Bill as framed would make the Secretary of Commerce absolute dictator and czar of radio. In the hands of Messrs. Hoover, Carson and Terrell we believe that power would be quite safe; in the hands of some other folks now gracing official Washington it would be misused without a doubt, leaving the country it is designed to serve quite helpless!

Most of the radio interests appearing before the Committee during the hearings

made representations along this line, and the Sub-Committee on Radio is now reviewing the matter. If the Sub-Committee acts in accordance with public sentiment as expressed at the hearings, it will limit this discretionary power in some manner. It must be limited! Several proposals have been made. One is simply to remove the various phrases in the bill which make the administration discretionary; then decisions would be subject to appeal to determine the facts in a case. Another proposal is that the discretionary power be lodged in a commission, instead of an individual, expanding the proposed Advisory Committee into a Radio Commission or perhaps a Communications Commission dealing with wire telegraph and phone, and radio, similar in nature and duties to the Interstate Commerce Commission. The adoption of either of these proposals will go a long way toward securing popular support for the bill. It is very much to be hoped that Mr. White's sub-committee will see the wisdom of making some such change before reporting the bill out.

As to the bill's chances of becoming law at this session of Congress, they seem fair enough if the bill is modified as proposed, for then there would be much public sentiment in favor of putting it thru and getting the job over with. If it is not modified to limit the wide discretionary powers, we do not believe it has a chance. Radiocorp and A.T.&T. are said to favor the bill in its present form, Westinghouse to oppose it, and almost all of the independent broadcasters oppose to it for exactly the reasons we cite as our own. With the Congress rocked to its pins anyway, and plenty of members ready to block grants of power in un-American fashion, figure it out for yourself. It certainly would be an immense relief, however, after all these years of words and efforts, to have a new radio law which would be fair and mutually acceptable. H.R.7357 can be modified to be acceptable. Let us hope the Committee will embrace the opportunity before it.

Don't Be Careless

WE offer our sincere sympathies to the amateurs of Australia in the unfortunate accident that has just cost the life of one of their keenest experimenters, Mr. F. L. Moore. While conducting some transmission experiments Mr. Moore came in contact with the high voltage and was electrocuted, a fatality all the more distressing because it was witnessed by his wife who was at his side during the tests and, even more so, because the widow and two little ones have been left without means. The Australian journal *Wireless Weekly* has inaugurated a relief fund for the dependents, to which the Australian amateurs are contributing.

It is a marvel to us that there are not more serious accidents among American experimenters. Fortunately they have been very exceptional, but the way the average experimenter works he has sudden death at his elbow every moment and it seems worth saying a word about. The average relay station in active service is a safe enough proposition, because it is semi-permanent, and consequently has had some pains bestowed upon it, but in the conducting of transmission experiments the average experimenter runs a maze of loose wires to various switches and pieces of apparatus on a table and then plunges his hand into the mess each time a change in adjustment is to be made.

Let every reader pause and give thought to this matter. It is so easy to make it safe. The ideal way, of course, is to spend a little time and do a neat foolproof job, with well-insulated wiring and insulated controls, but often this takes too much time, or at least we think it does. Here is the simple way to safety: Always have a power cut-out switch in every set-up, whether it is just for a half-hour's experiment or a permanent set. Mount it in a convenient position to one side of the apparatus, and then *open that switch* every time any piece of apparatus is to be touched. Do it *every time*. And if the apparatus includes condensers of considerable capacity or if they are being worked at appreciable voltages, ground or short-circuit the condensers (power off) by some device having a well-insulated handle, before touching any part of the circuit.

A little thought in this line will pay big dividends in longevity and will save the price of some flowers.

NOTICE TO OUR NEWSSTAND READERS

As announced in recent issues, The Traffic Department Report and the "Calls Heard" Department have been eliminated from the newsstand edition of *QST* because our non-member readers in general are not particularly interested in them. This results in a saving in expense which makes possible the publication of a larger and better *QST*.

These two departments are included in the edition supplied to members of the A.R.R.L. If you are interested in them, it is proof positive that you ought to be a member of the League. May we not direct you to the handy application blank appearing on page 88 of this issue?

The Navy's Work On Short Waves

Continuation of Amateur Reports Requested To Determine Range Of Shenandoah's New 100-Meter Set

By Dr. A. Hoyt Taylor,* Physicist, U.S.N.

No one can better prophecy the future of short-wave radio than can Dr. A. Hoyt Taylor, who has done pioneer work at every stage. Before the war few sparks outranged old 9YN at the University of North Dakota. Immediately after the war NSF-NOF, at the Anacostia Naval Air Station, leaped into prominence as the first really effective tube station. Soon afterward voice equipment was added and the 'phone of NSF was being reported from all parts of the Western Hemisphere while other 'phone stations were only just beginning. NSF then began to send musical programs and became the first long-range broadcasting station.

NKF at Bellevue has now replaced NSF-NOF and in its turn is doing pioneer work under Dr. Taylor's guidance.

The sending sets described in this article represent the experience gained in all this work. They will be finished soon and will be used regularly in the Shenandoah's work. It is hoped that there will be many flights this summer.

The Navy Department will appreciate the continued co-operation of amateurs in reporting the ranges attained on the short waves.

—Tech. Ed.

THE radio engineers of the Navy have followed with the greatest interest the astounding developments in short wave communication for which the amateurs of this country are so largely responsible, and which have demonstrated better than anything else the remarkable progressiveness, ingenuity and hangdog perserverance of the amateur. Most of us in this Laboratory have been amateurs in the past and, since that condition appears to be never fully eradicated by subsequent experience, we feel at heart that we are still amateurs in many respects. Therefore we take a pride in the achievements of the amateurs of this country which is scarcely second to their own.

I do not think that those who were connected with radio work in the military services during the war will ever forget the way the amateurs rallied to the colors when the country needed them. That spirit of coöperation did not cease with the conclusion of the war. I have in my files hundreds of letters from amateurs in something like 42 different states of the Union who coöperated with us when we were doing at NSF, later NOF, the pioneer work in high-power long-range broad-casting. To those old friends who coöperated with us, and with the Anacostia station, NSF and NOF, in those days, I would offer a word of explanation. NOF is no longer in the air as an experimental station for two reasons: First, the particular studies in which we were then engaged have long since been completed and commercial stations have taken up on a tremendous scale and brought to perfection that line of work in which we were particularly interested at NOF. Second, all of the Naval radio research and design interests have now been concentrated in the new Naval

Dr. A Hoyt Taylor, Physicist, U.S.N.
Photo courtesy U.S.N.

Research Laboratory at Bellevue, D.C., which officially went into commission last July. Only recently, that is, within the last few months, have we been in the air working with amateurs using the call NKF, our particular interests this time being in high frequencies (short waves). Again the amateurs have shown their splendid spirit of coöperation and we have worked large numbers of them, both by daylight and after dark, to our very great benefit and I hope in some cases to theirs, since we have always been glad to give them an accurate measurement of their wavelength using our standard heterodyne wavemeter, whose accuracy we believe is second to none. We can get these measurements just as easily on a station 1,000 miles away as we can on a station near the city. Since we have therefore a great deal in common with amateurs in this

*Superintendent, Radio Division, U. S. Naval Research Laboratory, Bellevue, D. C.

mutual interest in high frequencies, I venture these few comments and a further plea for the continuance of the coöperation and interest of the past, particularly with reference to the proposed polar flight of the *Shenandoah*.

We feel that amateur operators are in a position to give us not only excellent coöperation but excellent advice in many instances on account of their long experience in this end of the game, and if from time to time we can release certain information which we think will be of interest and benefit to amateurs, we believe that we shall be permitted to do so.

Photo courtesy U.S.N.

Our interest in short waves is by no means a new one. Since 1917 one of the standard waves on board every battleship has been 150 meters. From a modern point of view the apparatus is pretty crude, being a peculiar type of spark set which is now of no particular interest; nevertheless occasionally extraordinary long distances were reached with it.

Had amateurs in the last few years had receivers capable of tuning down below 200 meters, we would doubtless have had a great many more reports on our transmissions on 150 meters by these ships. Plans are now under way to replace this old equipment with modern tube sets of our own design. Most of you have recently heard NKF using 240 cycles ACCW—you were listening to the model set intended for this purpose. Our transmitters had to comply with certain conditions on board ship which are undoubtedly of great interest to amateurs because in the near future they will probably, owing to the pressure of complaints of broadcast listeners, be obliged to comply with similar requirements. The main thing is that the transmitter must not disturb other receivers on the same ship. These conditions compel us to design a short-wave transmitter capable of a hitherto unheard-of precision of frequency adjustment and with absolute continuity of oscillation (to take out shock absorption) and quite completely purified of harmonics. We have used one of these transmitters having 4½ amperes in the antenna in the same building where broadcast reception was being carried on. I hope sometime to release the details of these circuits. At the present time I can only point out that the results are obtained by the use of the master oscillator and power amplifier with the use of intermediate circuits, and that the continuity of oscillations is obtained by self-rectification in the master of both lobes of the alternating current, and by so regulating things that the oscillations never die down quite to zero even during the period when the alternating current supply is passing through zero.

Several years ago we made experiments with waves as short as 5 meters with most interesting results. There, the production of standing waves and the influence of reflections, obstacles, etc., is very marked.

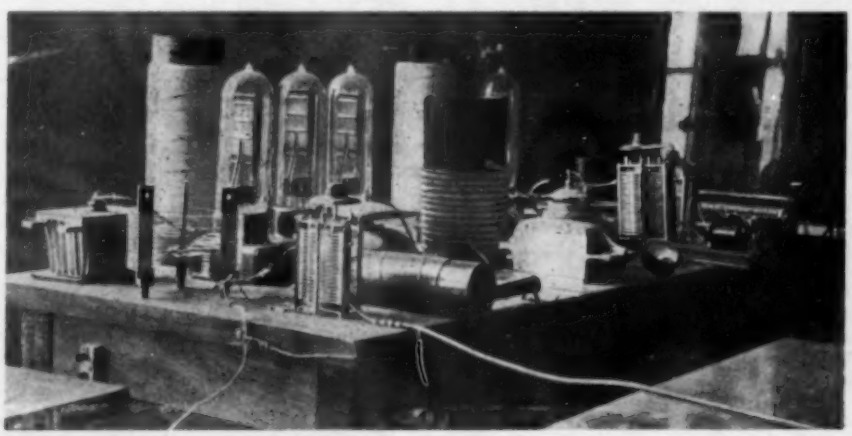
I can not lay too much stress on the consideration of keeping the wave constant and free of lilt and warble. It has been our experience at NKF that not one amateur in one hundred has a sufficiently constant wave to be read comfortably and clearly, and I believe that one-tenth of the power would frequently suffice for communication if the wave were absolutely steady and constant. It is the old story that the number of amperes in the antenna is not always the final determining factor of the range. With the use of a master oscillator and intermediate circuits, supposing that the amateur has a limited number of tubes and power supply, his radiation may be cut down somewhat, but the gain in the steadiness of the wave will, in my opinion, entirely offset this disadvantage. I should like to make the suggestion that more work be undertaken by amateurs on definite schedules and on constant waves, thus eliminating about 98 percent of the interminable "CQ-ing" which now fills the air. C.W. communication on short waves can only be considered a success when you can get your man with a short, brief call. This can only be accomplished by marked improvements in both transmitter and receiver. I have already indicated some of the lines that we are following in this Laboratory in the way of improving our transmitters. We have recently constructed a transmitter which will go down to 80 meters and whose wave is just as steady and just as easily copied with a suitably designed receiver as a long-

wave arc or machine. We have also completed a 3,000 kilocycle (100 meter) set for the *Shenandoah*, which we hope will be almost as constant, the details of which I will give later in this paper.

Pertinent suggestions have already been made concerning the design of the receiver in recent numbers of *QST*. I can add little, except to say that we rather favor a form of super-heterodyne which is especially adapted for CW reception, and that the receiver problem can not be solved completely without the use of an auxiliary and extremely constant heterodyne circuit which can be used to set your receiver exactly on a desired wave. It is extremely difficult, if not impossible, to build a receiver which can be set at 3,000 kilocycles for instance, to within ½ kilocycle of the desired frequency, but it is possible to fix up a receiving tube with a good condenser and a rigid coil system and with definite plate and filament voltage on the tube so that it will oscillate for many weeks within ½ kilocycle of the described frequency. Of course, the condenser should have extremely fine adjustment or else the method of step-condenser of sub-divided units made up with several fixed with one small variable can be used. With this kind of a heterodyne used as a wavemeter it will be possible to set in advance accurately the wavelengths of both transmitter and receiver, so that the very first call should get through. I remember the difficulty we used to have in the old spark days with everlastingly long calls and "CQ". This finally came to be considered a good deal of a disgrace and an indication of either poor material or poor operating ability. With the advent of CW, the "CQ-ing" and the long calls have come back again, and no wonder, since the transmitters are, as I have said, not 1% of them steady enough to do what I would call comfortable work with, and the receivers as pointed out by Mr. Kruse in recent numbers of *QST* are very poorly designed for our present purposes, but even with the best we can do with the receivers and transmitters, I think the heterodyne will, for operating on schedule, be an extremely valuable and inexpensive addition to the average amateur equipment. This heterodyne, I ought to say, should be properly shielded and must never be coupled any ways tight to any other circuit; otherwise its wavelength will not be reliable.

I believe the time will come when long calls and "CQs" will be considered just as much of a disgrace as they were in the most efficient period of the use of the spark among amateurs. My own observation leads me to believe that at present a great deal more time is taken up with long calls and "CQs" than in the actual transmission of messages or in the carrying out of tests. At the same time I see that without certain improvements such as I have indicated, the condition is inevitable.

One common cause for variation in wavelength in amateur transmitters appears to be undue forcing of the tubes. Again I will point out that the amperes in the antenna are not the only things that count. This forcing of the tubes has another bad

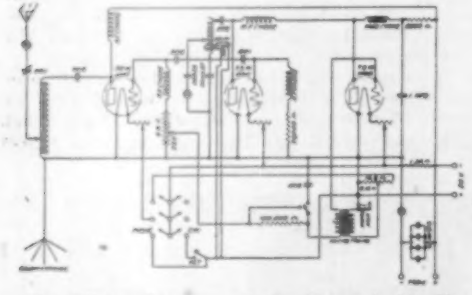


The transmitter at NKF. 250-watt master oscillator feeding three 250-watt power amplifier tubes. Plate input 1500 watts from 1000-volt storage battery. This set puts an earsplitting 50-meter signal into 1XAM by daylight during all weather conditions. On 50 meters the signal is better than on any wave between that and 110 meters.

The antenna is not near the transmitter but is located clear of the building and is fed by a R.F. transmission line. The antenna is a cage "T" 35 feet high and 35 feet long; the counterpoise is circular with six wires 25 feet long and 3 feet off the ground.

Official Photo U.S.N.

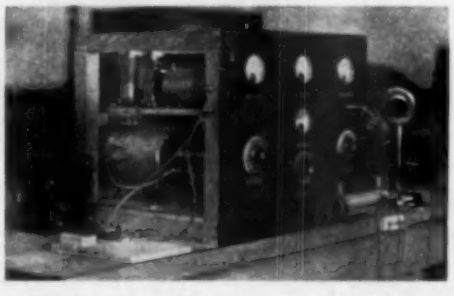
effect besides unsteadiness of wave, and that is the production of impact excitation giving undue interference with their immediate neighbors and production of harmonics. NKF has copied on about 100 meters (3,000 kilocycles) a large number of amateur stations who were actually transmitting in the neighborhood of 1500 kilocycles, and many of these stations were many hundred miles distant. In fact, I think we have had instances where the first harmonic at about 3,000 kilocycles came through stronger than the main wave at 1500 kilocycles. These errors can be largely corrected with a little care, a little more consideration for the rights of the other



The Wiring Diagram of the Shenandoah's New Master-Oscillator Power-Amplifier Short-Wave Set. Diagram courtesy U.S.N.

fellow and fuller realization that steadiness of wave is almost more to be desired than high antenna current.

Since we have undertaken more exhaustive studies of short-wave receivers, it has been very forcibly brought home to us that the greatest hinderances to effective work in this field are due to impact disturbances from faulty power transmission lines, bad commutators and other sparking contacts in electrical machinery, bad telephone lines, and radiation from X-ray machines used in hospitals and clinics. In addition to these, we fully realize that a very great evil is impure emission from commercial and Government high power transmitters, particularly from the large Navy arcs. Not all of the complaints of interference received by the Navy Department are warranted as the interference in question can be shown to be caused by the use of non-selective receivers. The experienced amateur is not so liable to make this kind of complaint, but the average broadcast listener usually expects to get Rolls-Royce performance out of a flivver set. Nevertheless we realize the great urgency of improving the station in regard to our high power arcs. It is only fair, however, to point out that we are faced here with a very serious situation. We have a tremendous investment involved in these arcs. It would require a special act of Congress to appropriate money immediately to replace these arcs with high power machines or tube sets. It is also well known that tube sets in very high powers are quite as capable of disturbing our friends the amateurs as some of the arcs unless they are carefully designed. We are attempting to relieve the situation by adopting means of purifying the radiation of the arc stations, for we realize the urgency of it as well as anyone. The problem is not so simple as might appear. We have already spent several hundred thousand dollars on this work and are still in doubt as to whether or not we have arrived at the best possible solution, especially for the very high power stations. I want to assure the amateurs that we are doing the best we can with the appropriation available, and hope that we shall have some very tangible results in the near future. People who demand an immediate change in such high power stations as Annapolis and San Diego can hardly realize the staggering cost of replacing such transmitters with tube sets with suitable power and purity of emission, or of putting in coupled circuits or such, for the large arcs. If they would stop to figure out the cost of a condenser suitable for handling 350 kilowatts and insulated for 125,000 volts, I think they would be surprised at the results. Nevertheless I think I may definitely state that the Navy Department is determined to cure as rapidly as possible the evils of the high-power shore stations, and plans are well under way as soon as funds are available to replace all



Portable Transmitter NKF-1. Wave length range 66 to 115 meters. This set frequently works 1XAM, South Manchester, Conn. (about 300 miles) in daylight with antenna 20 feet high. 9XAX has been worked easily on reduced power.
Photo courtesy U.S.N.

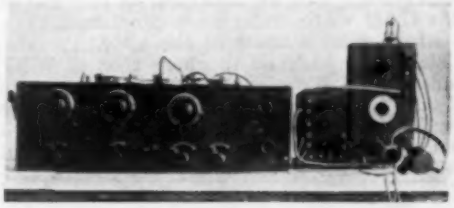
obnoxious shore spark stations with tube sets, at least as modern as those on the battleships. This will greatly mitigate interference from such sources with short-wave work.

Perhaps the most outstanding thing about high-frequency or short-wave work today is the amazing ranges obtained at frequencies in the neighborhood of 3,000 kilo-

cycles (100 meters). The intensity of signals received on these high frequencies is so great that I am forced to conclude that these waves do not follow at all the ordinary laws of transmission. It would seem that the absorption term in the Austin-Cohen transmission formula is conspicuous by its absence in the case of these waves. It is a curious thing indeed that in many cases a frequency of 3,000 kilocycles will travel with far greater strength over great distances by daylight than it will after dark. This is particularly true of the 104-meter broadcast from KDKA as received in Washington, although it is understood that at other points it is frequently stronger by night than by day. To me this would indicate that there is so complete a reflection of these waves at some upper and probably ionized layer of atmosphere, that they travel not as an ordinary radio wave, but more as a wave confined between two parallel planes. This leads to a far more favorable law of variation of intensity with distance. The ease with which these waves are reflected from high buildings and natural obstacles leads also to the formation of standing waves with points of maximum and minimum which gives in some places a very poor reception, but at other spots where a receiver is located the intensity may be unbelieveably great. Nevertheless, it is our experience and I believe a number of my readers will agree with me, that far greater distances can be bridged, especially by daylight, at 3,000 kilocycles (100 meters) than can be bridged by 1500 kilocycles (200 meters). I will be glad to do anything I can to stimulate the interest of amateurs in the reception of these very short waves. No one can tell now where the limit will be. There are so many frequencies available that an almost infinite number of possible channels of communication are to be had in the region of which I speak, so that there should be room enough for everybody, with certain moderate restrictions as to suitable bands wherein different interests could operate.

As before mentioned we have already had considerable coöperation from amateurs in observing intensity, steadiness, etc., of our own short-wave transmissions, but this is hampered by two difficulties. One is that so few amateurs are able to tune down to these frequencies. The other difficulty is that some of them apparently think when we give them a call from NKF that some Government station is about to criticize them for some irregularity in their own transmission, and therefore they do not answer the call. I hasten to assure everyone that our purpose in these tests is solely to obtain information which no one can give us so well as the amateurs themselves and that we hope that such tests as we make in the spirit of mutual coöperation will be for our common benefit. I notice that quite a few amateurs log our call in their list of stations heard, but on the other hand many whom we have actually worked do not log our call. This is natural since we do not operate with an amateur call, but we would appreciate very much having our call logged when heard on amateur wavelengths, or shorter waves.

We have been so impressed with the possible long daylight range of short waves that it has been decided to make the auxiliary set on the *Shenandoah* for the North Pole Flight a 100-meter transmitter. This will operate from 24-volt storage battery which is kept continuously charged during normal operation and good for a number of hours emergency operation. A sketch of the connections for this set is appended. There are two modes of transmission: first, by telephone for short-range work, particularly during landing and mooring operation; second, by straight CW. The plate voltage is 750 volts supplied by a motor-generator. The master oscillator and its associated modulator tube are both 7½-watt XL-filament tubes. The series resistance in the plate circuit cuts the plate voltage of these tubes to a suitable point. The power amplifier tube is a 50-watt XL-filament tube; the radiation is about 1.6 to 1.8 amperes. The effect of the series resistance in the present circuit of the master tube is to give the note a bad lilt on keying, if this is done in the usual manner by breaking the grid—therefore in order to keep the note even and clear, the wavelength of the master is altered by a relay operated by the key, said relay short-circuiting a turn of wire placed near the master oscillator coil. This shifts the wavelength several kilocycles, but since it does not cut the power off the tubes their operation is very steady. The set is very small and compact and has only the one wave. This method of keying is undesirable, but was necessary if we were to use a master tube requiring a lower plate voltage than the power amplifier. This we were forced to do on account of weight, space and power limitations. The *Shenandoah's* other transmitter is the most power-



NKF's Superheterodyne Short-Wave Receiver.
Photo courtesy U.S.N.

ful transmitter yet placed aboard any aircraft. It operates ACCW on a range from 500 to 200 kilocycles. The present plan is to have all transmission carried out simultaneously with the two sets. In other words, every communication sent out by the *Shenandoah* during her flight across the continent and during her polar flight will be made on two wavelengths; one of which will be 100 meters (3,000 kilocycles). It must be remembered that during the period when the *Shenandoah* will be in the far north, it will be continuous daylight in those regions and some very interesting information will be obtained by the use of this short wave under such conditions.

From what I know of the situation now, I should be inclined to guess that if WNP had had a 100-meter transmitter instead of 200, their communication with the States would have been far more certain. I would like to seek now the coöperation of the American Radio Relay League in connection with the polar flight. It may be that conditions will arise whereby the safety of the entire expedition will depend on the reception of this 100-meter wave, and the experience of the American Radio Relay League with this type of work leads me to believe that their coöperation with us during the Trans-Continental and polar flights will be of the utmost service to us. I hope there will be a good many 100-meter receivers on the job when the ship commences her flight. The *Shenandoah* receivers will be able to handle anything from 135 meters (2250 kilocycles) to 25,000 meters (12½ kilocycles).

Details of plans for communication will be given later. In the meantime we will be particularly interested to hear from amateurs and special stations who are in a position to make tests, particularly daylight tests, on high frequencies (short waves).

The Ultra Audible Microphone

By F. E. Burke, 8DGE

OUR old friend Doc Thomas, 8CFP, has got the bug. Sure as shootin'. I saw his picture in the paper the other day with a pair of phones on his ears, and a foolish grin on his face, and there was a big moth on the table. Under the picture it says "Dr. Phillips Thomas Listening to a Moth". I knew from that he'd got the bug.

Doc is a congenial fellow, a darn good guy at a hamfest, and has a mighty fine CW set, though he doesn't operate as much as he used to. He is also the legal father

of the arc microphone, the most sensitive device perfected for catching sound waves and converting them into pulsations in flow of electric current.

It isn't my object to poke fun at Doc or his invention, but to look into the future and to predict what may happen because of this invention.

The glow discharge between the electrodes is sensitive to waves of any frequency, audible or otherwise. Hence it makes a mighty handy piece of apparatus for use in picking up signals on any wave length. All that is left to provide is an oscillator to cover the necessary range and to heterodyne these signals and communication with the rest of the bugs is established. I forgot to mention that the arc can also be used as a generator of these frequencies. We are now all set to carry on two-way communication on any wavelength.

I forgot to ask Doc what wave length that moth was on, or if it was calling CQ. From the look on Doc's face I judge it had a bum fist, or that its antenna was swinging. Sure bugs have antennae. How could we communicate with them if they didn't?

It has been said that this microphone will be of great service to scientists. Let's take a case.

Suppose Prof. Anthrax, holding the seat of the chair of bugology at Dermax College, awakens in the night with a creeping sensation on his left leg. Suddenly a sharp tinge is felt in the affected member. He hastily thrusts his long lean limbs from under the sheets, snaps on the electric light and sees a small insect hop off his leg. Seizing his arc transmitter-receiver he calls 8BUG, the 8 standing for the *eaten* district, and signs PROF. The bug, being a bug, answers the CQ from this well known broadcaster and two-way communi-

cation is established. Considerable fading is experienced because 8BUG's left antenna got bent in the scuffle, if you know where that part of the antenna may be. PROF turns the loop on him and walks around the room taking readings on the compass. He soon gets the bug's QRA and, increasing power so as to block the bug's oscillator, 8BUG soon becomes a captive being. Kind of buggy, ain't it?

But to get down to something more practical, why not investigate light waves with this invention? Here is a grand opportunity to observe if the so called harmonious colors harmonize. In this case a separate oscillator to heterodyne the light waves is unnecessary. As long as the color combinations are harmonious, that is, the waves emitted by the colors being multiples, there will be no sound. But let color combinations appear which are what is known in music as "close harmony," with their partials and overtones, and beat notes will be produced. The greater the discord, the more the beats and the greater the disturbance heard in the ear-phones.

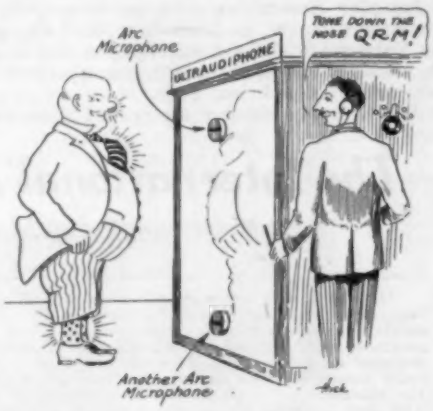
Let us consider some applications of this system. To say the least, it will make matters much easier for the interior decorator, for the fair damsel, for everyone who may have any interest in color combinations, and that includes all of us, I guess.

Suppose we wish to choose a necktie to harmonize with our socks. We drop into the haberdasher and make known our wants. The haberdasher glances at the socks and makes a guess as to the color scheme of a necktie to fit our needs. Glancing along the case he withdraws a tie and places it before an arc microphone. Another arc is trained on our socks, while we slip on the phones. A terrible jumble is heard.

Dr. Phillips Thomas, of the Westinghouse Electric & Mfg. Co., inventor of the Ultra-Audible Microphone, which has opened a new world of research. The noise a fly makes while walking, the thunder of a moth's wings in flight, the speech of the honey-bee—all are revealed with the aid of the Thomas microphone. Dr. Thomas is shown in the above photo broadcasting from Station KDKA the heart palpitations of the lovers' kiss which, with the aid of the ultra-audible microphone, were plainly heard by crystal-set receivers in England.—(International Newsreel Photo.)

"I'm afraid, old top, your B bat must be on the blink," is our remark.

"No", zezzee, "that's a loud combination". The tie is hastily withdrawn and the



noise ceases. Another attempt is made which is more nearly successful, but one of the colors causes some commotion. By shading out we find a green that is quite noisy. A tie lacking that color fits the bill so that nothing can be heard. It may be necessary to send out a few QRX or QRT signs to some of the bugs if the QRM from these quarters becomes too great.

Picture Milady preparing her complexion for the afternoon promenade. Before her lie her rouge, lipstick, eyebrow pencil, et cetera. On her head a pair of ear phones and to the right an arc microphone. She is arranging her complexion so that it is harmonious. A little dab of rouge, a touch of the eyebrow pencil, and she listens to her looks. After a little experience in coördinating ear and eye she

will be able to find the location of the discordant note in her color scheme without difficulty. It remains but to eliminate the discordant colors and her charm will be assured.

Interior decorating will no longer be a question of taste, at least that kind allowed by Volstead. The arc microphone will make it possible to be sure of harmonious color schemes of draperies, rugs, etc.

We are now facing an era of discovery which is far beyond our comprehension. How romantic to listen to the love-song of the cockroach under the lady-bug's window!

Has not the world been full enough of awful noises, A.C. growls, M.G. ripples, sync-rectifier grinds and hollow-sounding D.C. notes, that Doc Thomas needs must bring more still more weird noises and voices to our ears?

This is Effie Bee signing off. Good gracious.

The International Amateur Radio Union

By Hiram Percy Maxim, President, A.R.R.L.

It has been previously reported in QST that our President, on a personal trip to Europe, had been asked by our Board of Directors to represent A.R.R.L. in efforts to encourage international amateur relations. He carried with him our belief that there was keen need for an international amateur body in which A.R.R.L., representing American amateurs, could join with the other national amateur societies of the world in a common effort to promote and co-ordinate free amateur radio communication between the private citizens of the various countries of the world, represent the amateur in international communication conferences, encourage international fraternalism, etc. The idea met with a splendid response, and the I.A.R.U. is the result. Our dreams are coming true! —Editor.

IF American amateurs could see by radio as well as they can hear, they would have witnessed an inspiring event, the night of March the 12, 1924, in a certain dining room of the Hotel Lutetia in Paris, France. There was a dinner being given the President of The American Radio Relay League by the most distinguished radio men of Europe.

This A.R.R.L. President has sat in at a good many very impressive radio meetings in the past, ranging from Maine to California, but he has never sat in at a meeting where there was quite as much thrill as at this meeting in Paris where the amateurs of nine different countries sat down together.

Mr. Maxim in the "static-room" of the S. S. Belgenland on his return trip to this country. (Wide World Photo)

The countries represented were France, Great Britain, Belgium, Switzerland, Italy, Spain, Luxembourg, Canada, and the United States of America. Denmark was represented by a letter in which regret was expressed at the inability to have a representative present and asked that the amateurs of Denmark be counted in. Names familiar to every radio amateur in every civilized country were gathered around this historic board.

The chairman of the Inter-Society Committee of the three important French radio societies, Dr. Pierre Corret, presided. After the dinner he opened the meeting with a stirring address delivered in French, which it is a great pity was not recorded and translated for the benefit especially of A.R.R.L. members. In the most dramatic fashion Dr. Corret pointed to the great amateur society across the ocean which the world looked upon as a leader in not only the science of radio communication but in the humanitarian aspects of radio. He paid, with graceful eloquence, the compliments of Europe to the President of the A.R.R.L. and certainly placed it up to the latter to come through as he had never been required to come through before.

On such an occasion ponderous oratory seems out of place, and recourse was had to the simple American method of stating the case as exactly and briefly as possible and asking for its sincere consideration. The writer outlined what we in America believe would be the advantages of international amateur organization, and stated that American amateurs wished only to suggest and under no circumstances to be considered as dictating; that America offered every coöperation and help in its power, if such were wanted, and that it

was the earnest hope that some form of international amateur radio organization could be effected.

It would be difficult to describe the atmosphere that pervaded that dining hall at the completion of these two addresses. Those of us who have attended American "hamfests" have some idea of the thrill that went with this thing. Those who have never had this feeling are to be pitied. But can the American from Illinois who sits in with other Americans from California, Texas, Pennsylvania and Connecticut, and gets a real thrill, imagine the kind of a thrill that passes up and down the backbone when, instead of his own countrymen, his fellows hail from nine different nations! I do not believe I am overstating the facts when I say that every man in that room will remember distinctly all his life the keen thrill of that meeting in the Hotel Lutetia in Paris that evening of March 12, 1924.

The Dinner In Paris Where The International Amateur Radio Union Was Formed.

At a general meeting of this kind, where it is impossible to arrange a regular schedule of just what is to be done, it is always difficult to get something definite actually started. It was due to Comte du Waru of France that definite action was taken. He suggested that since several countries were represented, and that since it was the sense of those present that we form an international amateur radio organization, instead of putting it off for some indefinite time of the future we should do it now, while we were all together. He made the motion that a committee be appointed which would take charge of arranging the details for a permanent international organization, and that representatives from the various countries be selected and requested to meet as promptly as possible.

The writer was asked to call this meeting and two days later, on March 14th, at the Hotel du Louvre, Paris, a meeting of the delegates from each of the different countries was held. At this meeting, the writer was elected president and Dr. Corret secretary, and the committee was named The Temporary Committee of Organization. It was also decided to recommend that the name of the international organization be THE INTERNATIONAL AMATEUR RADIO UNION, and that a Congress to effect permanent organization be held in Paris during the Easter holidays of 1925, at which representatives from all countries were to be invited to be present. In the meantime the American Radio Relay League was invited to submit a recommendation for a constitution. This recommendation would be forwarded to the delegates of the Temporary Committee, and an effort made to arrive at an agreed-upon constitution to recommend to the Congress when it convened. The international language matter was also to be investigated by this Temporary Committee and a recommendation made.

Thus we have the beginning of a world-wide amateur radio organization which will probably be built upon lines similar to our A.R.R.L. Many Americans will without doubt find a way to attend this great-

est of all amateur radio conventions in Paris next Spring and there seems little doubt that the spirit of brotherhood that pervades amateur radio in America can be made to spread its mantle of good fellowship over all the civilized nations of the earth.

The Meissner Transmitting Circuit

*By I. V. Iverson, 7ADQ**

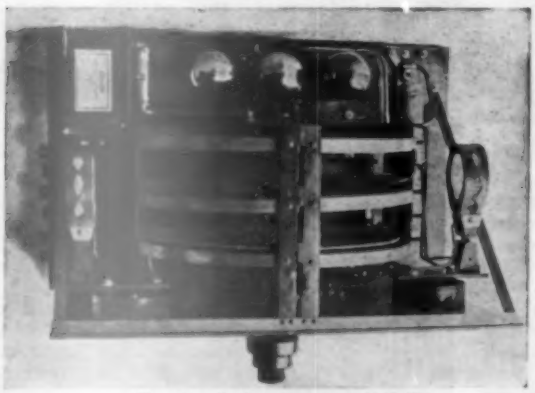
The Meissner circuit is very little used in amateur stations, mainly because the 3-coil form is hard to handle and the 4-coil form is little known. The 7th and 6th districts have been doing excellent work with these circuits, which have several advantages over the favorite circuits of other districts. The Meissner circuit shifts waves easily, does not get into trouble with the nodal point, works with grounds and counterpoises alike—and cuts down the keying thump that is such a nuisance when Hartley or Colpitts circuits are used.

By the way—the spelling is M-e-i-s-s-n-e-r and the name is pronounced as if it were spelled My-sner. —Tech. Ed.

THE kind of transmitter that is in demand by the amateur today is one that is efficient and at the same time flexible; that is, it must work with different antennas and be able to shift wavelength at will. The Meissner circuit gives all of these desirable things to the progressive amateur.

The Meissner circuit will work with a grounded antenna almost as well as with a counterpoise; most of the present amateur circuits will not do this.

The most pleasing thing about the Meissner circuit is that you can change from



The 3-coil Meissner set at 6JD

150 meters to 180 or 220 by simply moving *one* antenna clip or turning *one* antenna series condenser. The rest of the set will take care of itself.

In addition the Meissner circuit has the advantages of inductively-coupled circuits in general. (That is to say, it does not transmit key-clicks strongly, there is no worry about the nodal point, and a single antenna-series condenser is enough.—Tech. Ed.) What would you think of a fellow who today built a spark set and used straight or conductive coupling? You would think him crazy, not only for putting in spark, but for using direct coupling when inductive coupling has proven so much more effective. Yet you probably use a direct-coupled transmitter yourself. It may be C.W. but the same principle applies to both spark and C.W.

The Two Kinds of Meissner Circuits

The Meissner circuit resembles the Hartley circuit. See Fig. 1. The peculiarity of the Meissner circuit is that it has only one tuned circuit—the antenna—in spite of being inductively coupled.

There are two main forms of this circuit in use among amateurs today. One form is the "3-coil Meissner" shown in Fig. 2.

In this arrangement the three coils are the antenna coil L1, the grid coil L2, and the plate coil L3. The plate and grid coils are both coupled to the antenna coil; that is, one coil at each end of the antenna coil.[1]

The second form is the "4-coil Meissner" of Fig. 3. In this arrangement two antenna coils are used. They are placed at right angles to each other and as far apart as convenient. Closely coupled to the antenna coil L1 is the grid coil L2. Closely coupled to the other antenna coil L4 is the plate coil L3.

(In all of the figures in this article the tuned circuit is shown in heavier lines.)

The Condensers

With either of the above circuits the use of variable condensers will be found a great help. These should be placed in shunt with

*Chairman, Technical Committee, Amateur Radio Club of Seattle.

[1]—This circuit is used in the Western Electric broadcasting sets with a plate-coil condenser but no grid-coil condenser.

the grid and plate coils. The size of the condensers to be used should be .0005 microfarads maximum. The use of these condensers is not absolutely necessary (remember they are not tuning condensers.—Tech. Ed.) but the set is easier to adjust with them in the circuit. Ordinary receiving condensers are O.K. to use with powers up to 200 watts *input*, but for higher powers the use of a widely spaced

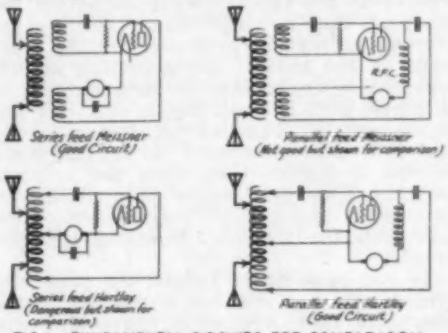


FIG. 1 — FUNDAMENTAL CIRCUITS FOR COMPARISON

condenser in the plate circuit is recommended.

The 3-Coil Circuit

Naming the coils in, Fig. 2 again, L1 is the antenna coil, L2 the grid coil, L3 the plate coil. C1 is the grid condenser, C2 is the grid-coil condenser, C3 is the plate-coil condenser, and C4 is the bypass condenser. The circuit will not oscillate without the bypass condenser but the size of this condenser does not matter—as long as it is big enough.

The size of wire on the plate and grid coils does not matter much but the antenna inductance should be constructed very carefully so as to reduce the resistance as much as possible.

The plate coil should be coupled as *closely* as possible and the grid coil as *loosely* as possible to the antenna coil. The closed circuits should *not* be in resonance with the antenna circuit; the tube action is aperiodic. (The currents in the plate and grid circuits are not oscillating in nature; they are only pulses at a rate depending on the antenna tuning. Therefore the antenna controls the wavelength and it is important not to have the antenna swing. But that applies to all other circuits except the master-oscillator power-amplifier.—Tech. Ed.)

To tune up the set, put the antenna clip on some convenient point on the antenna coil and then adjust the grid and plate coils either by means of clips, to regulate the number of turns, or by condensers, so that the antenna current reaches its maximum; then take your wavemeter and find out where you are. If you are too high cut out some of your antenna coil and adjust the set as before till the correct wave is reached. After the set is once adjusted the closed circuit need not be touched again, even if the wave is changed a great deal, for the antenna current will vary but little over the whole band 150-220. (The antenna current may be maintained steady by changing the adjustments of the plate and grid condensers. This change is very slight and for ordinary work it need not be done.)

It is very simple to change from a grid tickler or reversed feed back to the 3-coil Meissner. All that is needed is the addition of a plate coil. Nine times out of ten when you change over, even if the job is "haywire", the antenna current will rise and you will also get more consistent DX.

The 4-Coil Meissner Circuit

With the grid and plate coils placed as they are in the 3-coil circuit the full benefits of the Meissner arrangement cannot be had. There should be no coupling between the grid and plate coils excepting thru the antenna. But the three-coil system places the grid and plate coils on the opposite ends of the same antenna coil which means that there is certain to be coupling between the grid and plate coils. Where the plate and grid coils are coupled directly to each other oscillations will be

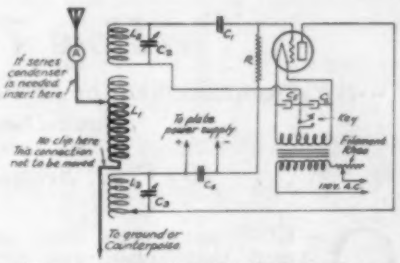


FIG. 2 3 COIL MEISSNER CIRCUIT *(Series Feed)*

L1—14 turns heavy wire on 6" form.
L2—15 turns almost any size wire on 6" tube when using condensers. 18-25 turns when working without condensers.
L3—18 turns on 6" tube when using condensers. 18-25 turns when working without condensers.
C1—.00025 to .002 microfarad.
C2 and C3—Good low-loss variable condensers, maximum .0005 microfarads.
C4, C5 and C6—.002 microfarads or larger.
R—1250 to 10,000 ohms, depending on tubes used.

Plate coil should be coupled closely to antenna coil. Grid coil should be loosely coupled. Since grid coupling must be adjusted exactly, it is suggested that the grid coil be mounted so as to rotate. A pancake grid coil can be used.

set up which are *not* on the antenna wavelength. The energy used to do this is lost, as far as the working wave is concerned; also this separate wave may cause correspondence with the Radio Supervisor's office.

The 4-coil Meissner circuit is the best

of the two by far, because in the 4-coil set the coils can easily be placed so that there

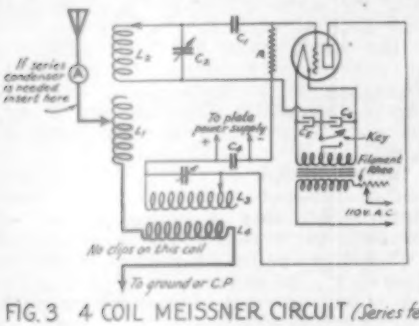


FIG. 3 4 COIL MEISSNER CIRCUIT *(Series feed)*

L1 and L4—each 7 turns on a 6" form or tube. Rest of coils and condensers same as in Fig 1.

Mount the plate coil next to the lower antenna coil L4. The coupling between these coils must be close and the number of turns in the antenna coil L4 should not be changed.

Couple the grid coil to the variable antenna coil.

Place the two sets of coils at right angles so as to prevent setting up local oscillation of an undesired wavelength.

is little coupling between the plate and grid coils excepting thru the antenna. This is as it should be. This does away with extra waves and puts all the power into the main, or normal, wave. The result is more miles-per-watt.

When the coils of a 4-coil set are properly arranged the set will not oscillate if the antenna is disconnected, and the plate current will drop to almost nothing. When things are working properly the set may be adjusted with the full plate voltage impressed on the tubes. When adjusting the set, first find a place where the highest antenna current is produced for the least input on the tubes. After getting an adjustment where a fair antenna current is produced with a small input, open the antenna switch. Now adjust the grid clip (or grid-coil condenser) until the plate current is lowest, then close the antenna switch. This grid adjustment should be made with care but the adjustment of the plate clip (or plate-coil condenser) is not so critical.

As has been stated before, the plate and grid condensers are not absolutely necessary but they are very convenient and condensers on both coils are to be preferred. Be sure the condensers are good ones because if they are not the end plates will burn up when working on short waves.

How To Use CQ

---An Announcement of Standard A.R.R.L. Practice on This Much-Discussed Subject---

By F. H. Schnell, Traffic Manager

CQ—HOW many times have you heard that signal and condemned the station using it? Perhaps too many to mention, because CQ has come to be regarded as a nuisance on the air. Stations using it have been classed as "CQ Hounds," but only because the signal has been abused and its proper use in amateur radio has been forgotten. Some stations fear to use CQ because of the name that goes with it; others decline to answer stations calling CQ; while other proudly boast that CQ has never been sent out from their stations.

None of these conditions is a healthy one and the purpose of this article is to announce a definite standard form for the use of CQ and which will be recognized as standard A.R.R.L. Practice, effective upon the publication of this issue of *QST*.

What is the primary purpose of CQ? It is a signal used to indicate that a station wishes to communicate with another station. Broadly speaking, that means the calling station has traffic for some other station. In amateur radio CQ has had a meaning which goes something like this: "I want some DX cards (which will never be QSL'd); will somebody please answer who is at a distance greater than 2000 miles so I can tell him 'nil hr drp crd cul 73 gn'." It has degenerated into the call of the DX-Card Hound who seldom acknowledges receipt of a report card. There are many other abuses of this CQ signal, and all of you are familiar with them—hence the desire to restore CQ to its good standing, because it is a most important signal when properly used. Too, we must have a standardized way of bringing about this desirable condition whereby CQ means something to stations hearing it, and here is how to use it.

1. Imagine your hook clear of all traffic but that you are ready to relay messages from other stations and you want other stations to know that you are on the air. For the purpose of illustration we shall use the call 9ZT—it's a good call and at 9ZT CQ is used properly. THE VERY FIRST THING TO DO IS TO LISTEN

AT LEAST FIVE MINUTES and make note of the stations you hear working and keep in mind your tuning adjustments for each station—know their wave-lengths, in other words. If there is some particular station you want to work, call that station, but if you hear stations relaying messages and you want them to know you are ready for traffic, then call CQ in this manner: CQ CQ CQ *u* 9ZT 9ZT 9ZT CQ CQ CQ *u* 9ZT 9ZT 9ZT CQ CQ CQ *u* 9ZT 9ZT 9ZT—then stop and listen. If you are a United States amateur and are calling Canadian amateurs, use the interval *cu;* if calling amateurs in England, *gu.* For any European station, make it "CQ EUROPE", and use the interval *u* if you are U.S.A., *c* if you are Canadian. (See December *QST*, page 19, for proper intervals.) The idea is not to keep this up all night and abuse CQ—call NOT MORE THAN ONCE OR TWICE EVERY FIFTEEN (15) MINUTES if you fail to get in touch with stations on the first call.

No station should ever use the bad form of calling CQ more than three times without signing the same number of times. We have heard station after station call CQ anywhere from ten to a hundred times (at a speed beyond the ability of the operator—no one could read it) and wind up by signing once, poorly. Stations are not interested in listening to two or three minutes of "CQ-ing"—they want to know who is doing the calling.

2. Suppose you have traffic on your hook and you wish to clear it. Sort your traffic into four files: that going north, east, south, and west. Knowing your geography, this is an easy matter. Then try to get in communication with certain definite stations which you have made note of while listening for five minutes, being sure your direction is right. After you have failed to reach a particular station and assuming you are trying to clear your north-bound traffic, then call CQ in this manner: CQ NORTH CQ NORTH CQ NORTH *u* 9ZT 9ZT 9ZT CQ NORTH CQ NORTH CQ NORTH *u* 9ZT 9ZT 9ZT CQ NORTH CQ NORTH CQ NORTH *u* 9ZT 9ZT 9ZT—then listen for replies. Stations hearing this will know you have made a definite request—you have indicated that you have traffic for stations to the north of you. Properly carried out, only stations to the north of you will answer. Sometimes it is desirable to relay messages directly into a city where you know stations are operating. Instead of calling "CQ NORTH" or any other direction, merely call "CQ" and insert the name of the city. Washington, for example, would be called like this: "CQ WASHINGTON"—in above form.

Remember—three calls, three signs, repeated three times, will be Standard A.R.R.L. Practice.

If you have traffic for stations in more than one direction, try to clear one direction before you start on another. By all means DO NOT CQ for all directions because you can work only one at a time anyway, and this sort of practice will defeat the purpose of the genuine use of CQ. Try one at a time.

Standard A.R.R.L. Practice does not mean that additional signals may be hitched on to the above such as QSR? QRV? QRK? etc. This is superfluous—let's stamp it out entirely and when you hear a station abusing CQ, call his attention to it by card or by letter.

The Eastward Voyage of the Tahiti

In a special little radio cabin on the after-deck of the R.M.S. Tahiti, on her recent voyage from Sydney to San Francisco, was installed the apparatus comprising the first shipboard amateur experimental radio station. Manned by two eminent Australian experimenters, Mr. Chas. D. Maclurcan, 2CM, and young Mr. Jack Davis, 2DS, the results obtained in hearing and communicating with amateurs on both sides of the Pacific during the voyage were splendid. The plans and preparations for the trip were reported in an article on page 20 of the February QST. The present article deals with their experiences on the voyage from Sydney to San Francisco.

THE recent voyage of the R.M.S. *Tahiti* from Sydney to San Francisco and return was quite an adventure for Mr. Chas. D. Maclurcan and Mr. Jack Davis, the operators of the experimental radio station that had been placed aboard, with the call 2CDM. This was the first time in history that a complete amateur sending and receiving station had been given a chance to show what it would do under the good radio conditions usually encountered by a ship at sea and for this reason the occasion was watched with great interest by amateurs thruout Australasia and America. However, this was secondary to the main purpose of the expedition which was to test the range of Mr. Maclurcan's low-power station at Strathfield, Sydney, and to observe the strength of its signals, fading, and other unusual things as the ship neared the Pacific Coast of the United States.

The few days before sailing from Sydney were busily occupied in getting everything

in readiness. Apparatus was tested and schedules arranged. Mr. F. Basil Cooke, assisted by Mr. Bon Gow, was to take charge of station 2CM at Strathfield in Mr. Maclurcan's absence and transmit to the *Tahiti* at specified times each day. If conditions were good the *Tahiti* would reply and advise how 2CM's signals were received. The periods during which the operators on the ship would be listening were widely published throughout Australia, so that other amateurs could also transmit to the *Tahiti*. These schedules were printed in *QST* for April on page 45.

The transmitting apparatus installed on the ship was a duplicate of one of the sending sets at 2CM and is clearly pictured in the accompanying photographs. The receiver was a four-tube honey comb coil set using one radio amplifier, detector, and two audio amplifiers. This apparatus was installed in a small radio cabin about five feet square, located on the after deck of the ship. The small photograph shows this house, lashed down to prevent its being carried away. The antenna was strung between it and the top of the mainmast nearby. The upper part was fanned out and secured to a yard while the lower end was made into a small cage. A counterpoise was also erected on the ship. Plate power for the sending set was furnished by a small motor-generator set running on the ship's 110-V. D.C. supply. The filaments were heated by current from a storage battery.

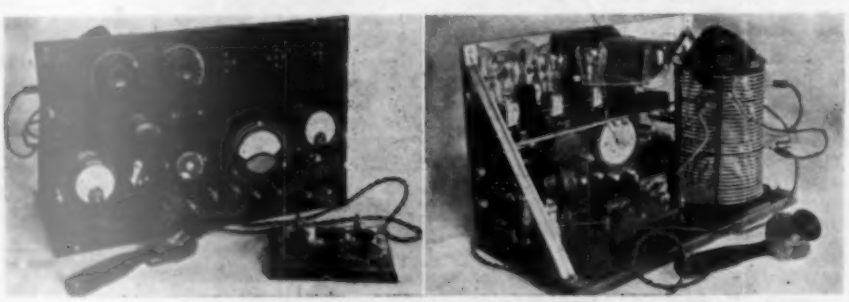
Just before leaving Sydney the set on the *Tahiti* was tested and worked well. The transmitted wave length was 220 meters and the call 2CDM. The set continued to perform excellently on the first four days of the trip. 2CDM was in almost constant communication with amateurs in Australia and New Zealand by CW and by voice, while many U.S. amateurs were heard. On the fourth day out, however, trouble was experienced with the high voltage generator which finally burned out entirely. Hard luck!

The next day the *Tahiti* arrived at Wellington, New Zealand, and tho amateurs from all around were on hand to wish the expedition good luck and success, they willingly spent the day scouring the town for a high voltage generator instead. One was finally located and with the help of old 4AA, Frank Bell, it was installed and belted to the original motor shortly before the ship sailed.

One hour after leaving Wellington the set was started up and three 5-watt tubes promptly went to the land of eternal radiation. The two spare tubes were brought out, but one of them proved a "dud" so 2CDM was doomed to use *only one UV-202* in the sending set until the ship arrived at San Francisco.

The Five Watter Does It

In spite of the above handicaps, communication was maintained with Australia and New Zealand up to 1800 miles out, and a few days afterwards 6AKW was worked at 1000 miles, reporting 2CDM as very QSA. While working 6AKW the set aboard the *Tahiti* using the lone 5-watt tube was heard by 9DSW at Fairmont, Minnesota, who reported his signals as very readable. Tho unable to reply on account of the limited power available, the operators on the ship heard Australian 2CM's signals up to 4300 miles on voice and 5380 miles on CW. It was only the terrific interference from U.S. amateurs as the ship neared the Pacific Coast of the United States that prevented 2CM from being heard QSA all the way to San Francisco. With less interference Mr. Maclurcan is confident that 2CM could be heard in the United States consistently.



Two views of the sending set on the "Tahiti" used by Messrs. Maclurcan and Davis to communicate with amateurs while crossing the Pacific. This set is very similar to one of the sets at Australian 2CM at Sydney. It uses three UV-202 tubes connected in the well known reversed feedback circuit with parallel supply. Grid modulation is used for phone. It is a very neat and workmanlike job and shows more than ever that the Australian amateur knows more about short wave tube transmitters than does the average American ham.

The matter of wave lengths is important if U.S. stations are to be worked regularly from Australia. Because Australians are licensed to transmit on about the same waves as we, there is not a chance in the world of their signals being heard thru the QRM on this side. The use of wave lengths above or below those used by American amateurs is the only recourse

The special radio cabin on the after deck.

and Mr. Maclurcan intends to see what can be done about this on his return to Australia.

Many American amateurs were received on the trip over, as is shown by the list of calls heard that is published under the heading in this issue. In fact, so many are heard in Australia and New Zealand that their reception there is getting to be quite boresome, according to Mr. Maclurcan. Excellent results were obtained in receiving American broadcasting during the voyage. Within just a few days after leaving Sydney, the carrier wave from KGO at Oakland was picked up in the middle of the afternoon, and, by listening steadily the signals gradually got louder as darkness crept over the earth. The modulation began to come through long before sunset and finally, one hour before sunset, a loud speaker was going on the deck, entertaining the passengers with concerts from KGO. Another station was picked up which turned out to be KHJ at Los Angeles.

The U. S. Is Reached

On arriving at San Francisco the Australian experimenters were met by Mr. A. H. Babcock, A.R.R.L. Director, and other radio men prominent in the Bay district. A large hamfest was held at the Engineers' Club where Messrs. Maclurcan and Davis were guests of the A.R.R.L., and at which those present learned much about amateur radio in Australia and the details of the trip across. Because of the short stay in San Francisco there was not time enough in which to visit very many stations or to gain much of an impression of amateur radio as it is in the United States. Mr. Maclurcan and Mr. Davis did comment, however, on how we amateurs used so much of our time in useless calling and creating unnecessary interference when we should be listening, which, in their opinion, greatly decreases the effectiveness of our stations.

By this time the *Tahiti* has returned to Sydney. The experience of Messrs. Maclurcan and Davis in being the sponsors of the first amateur experimental station on shipboard has proven very interesting and instructive. The radio world greatly appreciates the work they have just completed, for the venture has been a step forward in the progress of amateur radio.

—*H.F.M.*

Somebody is gonna be sick.

War Service Records

SAY, for the luvva μ, is it impossible for A.R.R.L. Headquarters to compile a trustworthy record of amateur wartime radio service? The response to our request is pitifully small; we can write from personal knowledge the records of almost as many men as have reported. This is not a matter of modesty, fellows—we want this record for the protection of Amateur Radio. You should do your part in its compilation by sending in your own record. Please see the questionnaire on page 37 of March *QST* (if you haven't a copy we'll send you a mimeographed one on request) and come across.

A Two Range Tuner With Low-Loss Coils

*By J. J. McLaughlin**

YOU say, O.M., that you have never seen a satisfactory way of adding a loading coil to the secondary of a tuner when you want to reach higher waves. Neither have I, but it can be done while still keeping the efficiency quite high.

You will notice from the photos and the diagram that the loading coil is cut in by

a camswitch which is placed between the load coil and the secondary to keep the leads short. When the load coil is "in" it is placed in the secondary circuit at the "low" side of the secondary. In some ways this is not quite as satisfactory as placed in the grid side of the secondary, but the switch is further down in the system and the losses are less. Certainly the efficiency is better than that of a lot of commercial sets.

The main difficulty comes in getting the tickler to work properly with and without the load coil. It took me a week to get a tickler that would work OK—I made 24 different types. The final one has 23 turns

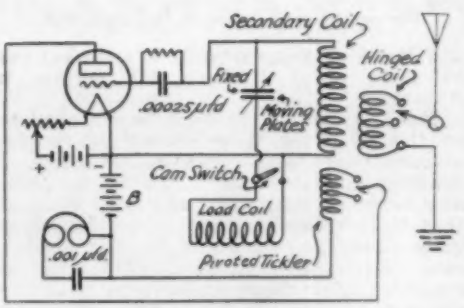
and is tapped at the 11th turn for the short-wave range.

The circuit used is the plain "loose coupler with a tickler" that has been used in most of the tuners recently shown in *QST*.

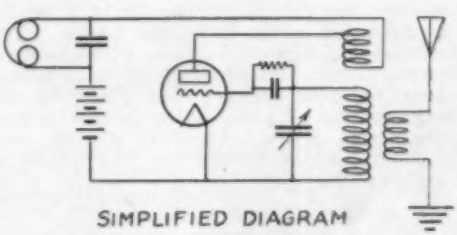
The primary consists of 10 turns of No. 16 D.S.C. held together with thread at 4 points, and tapped at the 5th turn for short waves. The coil is mounted on a bakelite block which is hinged and controlled from the front of the panel by the lever and link system shown in the photograph.

The secondary consists of 24 turns of No. 16 D.S.C. wound on a frame made of two bakelite rings and 6 bakelite strips. The turns of the coil are separated a distance equal to the thickness of the wire. The diameter of the coil frame is 4¼".

The tickler is wound with 23 turns of No. 28 D.S.C. wire tapped at the 11th turn for the short waves. The winding form



ACTUAL DIAGRAM



SIMPLIFIED DIAGRAM

for the tickler is made of a 3" bakelite tube with most of the tube cut away, leaving a skeleton. The winding is in two sections, 11 turns on one side of the shaft and 12 turns on the other side. The turns in each section are placed close together.

Both the tickler and the primary are at the low-voltage (or filament) end of the secondary.

The secondary load coil consists of 36 turns of No. 23 D.S.C., wound slightly

*c/o Hotel Savoy, Rochester, N. Y.

spaced on a frame much like the one used for the secondary but 4¾" in diameter.

The secondary condenser is of Allen D. Cardwell make, with a capacity of .00025 microfarads.

Wavelength Changes

The short-wave range of the tuner is from 76 to 225 meters. The upper range is from 200 to 420 meters. In going to this upper range it is necessary to cut in the entire primary coil, cut in the rest of the tickler, and add the loading coil to the secondary circuit. The loading coil is switched in by the camswitch which has been described before. The extra tickler turns may be switched in by means of a small switch on the panel or by using some of the contacts in the camswitch. The first plan is very much better electrically but the second is a little more convenient.

The extra turns in the antenna coil had best be switched in by using a clip on the primary coil, or by providing an extra primary binding post as indicated in the diagram, the antenna lead being shifted as required. It is better to leave this adjustment independent as it is sometimes convenient to be able to get extremely sharp tuning on the upper range of the tuner by using only 5 primary turns.

Although a fixed grid-leak is shown, a Cutler-Hammer variable grid-leak with a .00025 Micadon condenser is now being used.

Financial Statements

IN accordance with instructions of the Board of Directors the following statements of revenue and expenses of the A.R.R.L., for the quarter ending Oct. 31, 1923, and for the two months ending Dec. 31, 1923, are presented for the information of the membership. The books were closed on Dec. 31, 1923, after a period of but two months, to comply with the new Constitution, which specifies the calendar year as the League's fiscal year. Future reports will be quarterly.

K. B. WARNER, *Secretary*.

CONDENSED STATEMENTS OF REVENUE AND EXPENSES

	Quarter ended Oct. 31, 1923		Two months ended Dec. 31, 1923	
REVENUE				
Advertising sales	$19,622.47		$15,325.36	
Newsdealer sales	8,290.05		5,775.10	
Dues and subscriptions	5,447.96		5,750.68	
Back numbers, etc.	644.33		328.58	
Emblems	472.00		326.00	
Interest on bank deposits	56.95		14.37	
Bad debts recovered	29.96		38.95	
		$34,563.72		$27,559.04
DEDUCTIONS				
Returns and allowances	3,016.40		2,715.69	
Exchange and collection charges	9.47		4.05	
Discount 2% for cash	260.87		220.18	
Allowance for probable newsstand returns			490.25	
		3,286.74		3,430.17
		$31,276.98		24,128.87
EXPENSES				
Publication expense	12,126.96		8,784.44	
Salaries and commissions	11,667.16		8,810.29	
Forwarding expense	336.15		428.24	
Telegraph, telephone and postage	1,344.62		1,197.83	
Office supplies and general expense	3,145.56		1,581.19	
Rent, light and heat	711.34		238.86	
Traveling expenses to National Convention	1,171.93			
Traveling expenses, other	962.16		628.57	
Depreciation of furniture and equipment	96.02		69.96	
Bad debts written off	296.37		358.60	
Traffic Department field expenses	573.16		328.94	
Publicity Department field expenses	75.68		23.89	
R.O.W.H. buttons			100.00	
		32,501.11		22,550.81
Net Gain or Loss From Operations	*Loss*	$ 1,224.13	*Gain*	$ 1,578.06

THE RECEIVING EXPERIMENTER

The Neglected Grid Leak

By S. Kruse, Tech. Ed.

NOTHING about a receiving set makes more trouble, and gets less attention, than the grid leak.

To be good, a grid leak *must* have the right resistance, *must not* change with the weather, and must make good contact. That is simple enough but many grid leaks do not do it.

The Pencil-Mark Grid Leak

The simplest grid leak of all is a pencil mark on a strip of insulating material as shown in Figure 1.

When making a leak of this kind do *not* use a fibre, paper or cardboard strip. These things are no good because they soak up moisture in wet weather. Every time it rains you have *two* grid leaks, the pencil mark and the fibre strip. A strip of hard rubber is good and one of Bakelite-Dilecto is the best of all. Sandpaper the strip so that it will take a pencil-mark.

Drill two holes thru the strip as shown. The size depends on the machine screws you intend to use. The distance between the holes can be half an inch or an inch.

Now begin with a "No. 2" or "B" pencil and make a good heavy "blob" around each of the drilled holes and running out toward each other as shown.

Then put the screws into place and clamp the tinfoil washers down hard on these "blobs". This makes sure of good connections.

Adjusting

Connect the leak into your set and turn on the tubes. Very likely the detector will be cranky in operation, will howl at the least excuse, and will give weak "tinny" signals.

Run a pencil mark between the two blobs and listen again. Then make the pencil mark a little heavier. Finally the detector will settle down to business, the signals will have a "fuller" sound, and the tendency to squeal will not be so great.

Another way of telling if the resistance is right is by working the tickler back and forth. If the leak resistance is too high the tube will "bang" in and out of oscillation. As the resistance is reduced the action becomes smoother and less violent.

Using either scheme the resistance should be lowered until the tube behaves—but no more; too low a resistance will cause the tube to "play dead". It will oscillate easily but will not be sensitive.

Other kinds of leaks can be adjusted by the same rules.

Carbon Paper Grid Leaks

Carbon-paper grid leaks that are not sealed in glass tubes should not be used—they are generally unreliable and when they go wrong there is no way of adjusting them.

Sealed Grid Leaks

Of all the fixed grid leaks the best ones are those sealed into a glass tube. That does *not* mean that any grid leak in a glass tube is good—many of them are not sealed airtight and the connections to the little carbon-paper strip are carelessly made. These things are entirely unreliable, their resistance changes with the weather, they become noisy—throw them away.

There are several makes of good grid leaks, carefully sealed in and correctly labeled. Some of these use a carbon-paper strip with metal clips crimped on the ends, others have a thin grayish film of metal "flashed" onto the inside of the tube. Such leaks are almost always good.

Of course a good sealed-in leak is not useful unless it has the correct resistance. 1.5 megohms is a good average value but be sure to try several sizes on your tube; it may take a leak as low as .5 megohm or as high as 10 megohms. A gas tube like the UV-200 or C-300 sometimes does its best work with no leak at all.

Adjustable Leaks

Adjustable grid leaks are very handy because they can be very easily set to the right value for a particular tube. It is very important that the setting *stay put* after it has been made, otherwise the leak has to be tinkered with constantly. There are several excellent variable leaks on the market. Some of them fit the usual grid-leak clips, others mount on the panel. When using the panel-mounting type be careful! Don't mount them within several inches of any metal shields or grounded binding posts.

Concerning Tinkers

Directly opposite the man who forgets the grid leak is the man who "monkeys"

with it constantly. I watched one of these nervous chaps for a couple of hours one evening—whenever a signal was weak he "hiked" the leak resistance to make the tube more sensitive, and the next instant it had to be set back. The result was a cat concert.

There is no excuse for this—use a good sealed-in leak, a good adjusable leak, or a well-made pencil mark. Set it, and then leave it alone as long as the set works well.

Noisy Grid Leaks

All kinds of grid leaks get noisy in time, usually because there is a poor connection somewhere. If this happens with a sealed-in leak throw it away and use a new one. Make sure that the trouble really is inside, tho.

Accidental Grid Leaks

On some sets changes in the grid leak do not seem to have much effect, or perhaps no gridleak seems necessary.

This often means that there is an accidental leak somewhere. The grid side of the secondary circuit should be run so as to touch the fewest possible places and at these places it should be supported on the best possible materials. Such things as "moulded mud" sockets, panels, grid-leak mountings, etc., are very bad. I have seen composition gridleak mountings with a resistance of less than .2 megohms. Of course they entirely spoiled the working of the tube.

To be safe, use sockets of porcelain, rubber composition or bakelite, grid leak mountings of porcelain, rubber or bakelite, and stay away from everything else as far as possible. If you can help it, don't use a secondary switch.

Soldering "Dope"

It has been said a thousand times yet the majority of homemade sets (and many commercial ones) pay no attention to the rule that *nothing but rosin flux must be used in a radio receiver.* A set absolutely will not work decently with a thin layer of "dope" on the socket and the grid-leak mounting. If you make the set, *use rosin.* If you buy it and suspect soldering dope, try giving the suspected part a bath with alcohol and a toothbrush. After that go to the dealer who sold you the set and give him hades.

Poor Grid Condensers

Because a grid condenser is shunted by a grid leak, many operators think that "any old thing" will do as a grid condenser.

This is not true; a poor condenser changes with the weather. Use a good sealed-in mica condenser. Make sure that it is good by trying several, as even the best makes go wrong occasionally.

Above all things avoid these little paper contrivances containing a badly made paper condenser and a carbon-paper leak.

Mounting The Leak

A well-insulated adjustable leak like the Bradleyleak can be panel-mounted but must be located so that it does not come close to grounded shields, etc. It should also be kept 4 or 5 inches from tuning

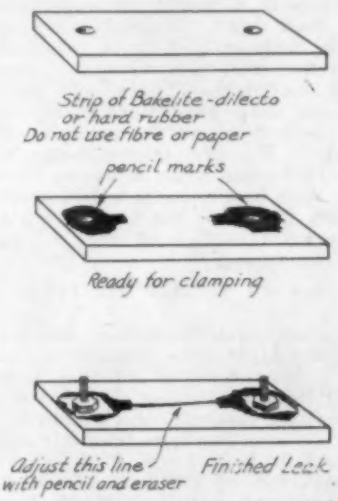


FIG. 1 MAKING A GOOD PENCIL-MARK LEAK

verniers, otherwise there will be hand-capacity trouble.

Clip-mounting leaks should be located to suit the circuit. Run the grid lead in a reasonably direct line from the tuning apparatus to the detector socket. Do not invite trouble by mounting the condenser or the grid-leak clip on a metal part of the set. Better go to the opposite extreme and support it in the air on the grid-circuit wiring, or else support from the grid post of the socket.

The Pan-American Tests

By F. H. Schnell, Traffic Mgr.

DON'T let the dust accumulate on your transmitter and receiver until you have put a signal into the South American countries and until you have copied a signal from down that way.

The Pan-American Tests are going to be a different order of tests. We appreciate the large look of dismay that looms up when we mention tests which require us to keep our junk sealed for so many hours per day right when we could be doing some good work. Cheer up; outside of the

regular "Quiet Hours" which we all must observe, there will be no request for quiet air during the tests. The heavy cloud of gloom can now go and jump in the lake or some other suitable place.

For a good many months we have been trying to get something on which to work tests with our southern neighbors and there has been a world of enthusiasm eminating from down there. We are now prepared to announce definite dates for these tests and we want to see a bunch of logs on reception. There will be no trouble to get the transmitters going—our weakness seems to be on the receiving end in all tests. We can transmit—no one will doubt that—but when it comes to receiving we have had to hedge a bit, not because we are incapable but because we are inclined to want to "do all the talking."

Here is the scheme:

Dates: May 19 to May 31, 1924, inclusive.

United States and Canadian amateurs transmit every night from Midnight to 3:30 A.M., E.S.T. Wave-lengths 105 to 125, and 150 to 200 meters. During this period all South American amateurs will listen.

South American amateurs transmit every night from 9:00 to 11:00 P.M., E.S.T. Wave-lengths 105 to 125, and 150 to 200 meters. During this period all North American amateurs are asked to listen. (Note these transmissions are on the same dates as the North American transmissions, which means they are on the following "nights".)

Through the good efforts and coöperation of *Revista Telegrafica*, the tests become a reality and it is up to us to carry out our program. We promised signals from about 5000 transmitters but that isn't the part to think about. What we want is your log of reception of signals from their stations—everything in connection with anything that looks like something from their stations. They may transmit in Spanish or Portugese; whatever it is, please let us have it.

As a means of identifying your transmission, you are to select some code word or make it up yourself—not more than eight or ten letters. You are to change this code word each night, but be sure to keep a record of your transmission every night. Make your log complete, don't leave it in such a state that there will be some question of your transmission when it comes time to check up. Send a copy of your log to A.R.R.L. Headquarters.

There is no particular station to call. Call "South America" if you want to, but be careful of your sending—make it clean and keep your speed to about 12 words a minute. The idea is not to call all during the test periods; be sure to sign frequently so they will know who is doing the calling. The proper method will be to send your code word three times and repeat your call three times. You may transmit as long as you like during the transmission periods.

Good luck!

The Third Michigan A.R.R.L. Convention

ON February 28, 29 and March 1st, at the Tuller Hotel in Detroit, there took place the Third Michigan Annual A.R.R.L. Convention.

Men from Northern Ohio, Indiana, Illinois and Michigan were present and the usual gabfest, which is notably present at all ham meetings, showed that the annual get-to-gether meetings are thoroughly enjoyed.

On Thursday, February 28th, registration and visits to amateur stations took the entire day and evening. The casualties on the trip consisted of one blown-out tire, two broken wheels and a crumpled fender.

On Friday, February 29th, John L. Reinartz—"Kewpie"—had the busiest day in his history. At 9:30 A.M. he gave his talk on short wave receivers and his thorough, detailed explanation of the various circuits was eagerly absorbed by everyone. From now on it is expected that Michigan will be full of high grade transmitters doing better work for the League.

In the evening, a burlesque broadcasting station, JAZ, caused much merriment with its "hay wire" operation and grotesque behavior—many humorous telegrams and letters from B.C.L's. hearing (?) the concert were read — spirits ran high!—Operator Mitchell of WCX was Chief Announcer.

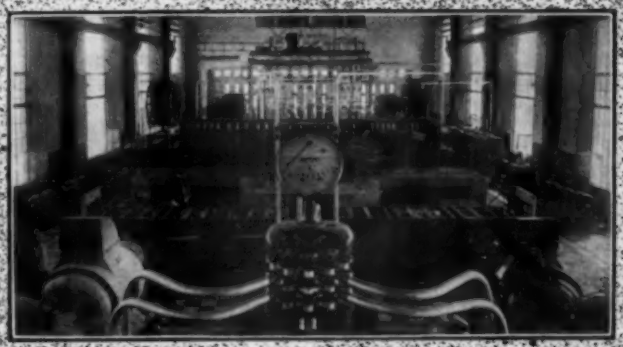
Saturday was given over to a traffic meeting in A.M. and to a special meeting for the Amateurs and B.C.Ls. in P.M. Radio motion pictures were shown at all meetings.

Saturday evening closed the big day with a banquet and speeches by various radio men. A number of prizes were awarded to the holders of lucky numbers. Among these prizes were a complete 100-watt transmitter, a receiving set and a mysterious 250-watt transmitting tube that was accidentally dropped just as it was being presented to Marco of 9CD.

Later the Flint gang put on the Royal Order of Wouff Hong. This was splendidly done by capable men.

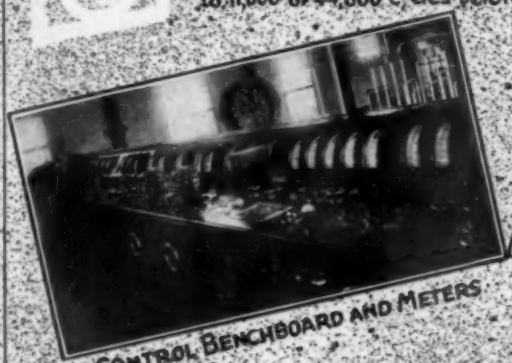
One outstanding feature of the banquet was a suggestion by friend Schweitzer, 9AAW of Chicago, that we get a silver cup and present it to the Club showing the most "men miles" attending national conventions. A subscription was taken and we've got the cup—who wins it?

Clyde Darr, 8ZZ, was Chairman of the Convention.



MAIN APPARATUS ROOM

6000 cycle 750 K.V.A generators in foreground with transfer switch between them. The current is converted to 11,000 or 44,000 cycles before being fed to the antenna.

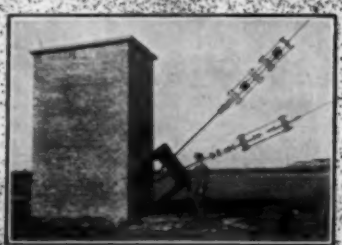


CONTROL BENCHBOARD AND METERS

THE KEYING RELAYS

INSULATED MAST FOUNDATION ON THE GERMAN TYPE MAST

BANK OF CONDENSERS WITH TUNING INDUCTANCE



GUY ANCHORAGE

THE NEW INTERNATIONAL STATION LPZ AT MONTE GRANDE, ARGENTINE REPUBLIC.

There are ten towers, eight of which are 680 ft. high and two 710 ft. high. Six of these towers are the German type and four of the French type. Normal antenna current is between 400 and 500 amperes representing about 300 K W in the antenna.

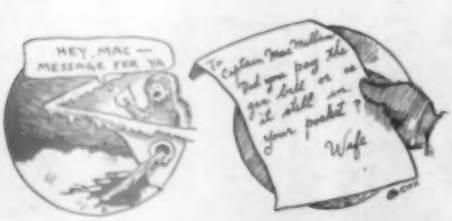
Bowdoin Continues But Communication Poor

MACMILLAN'S Arctic schooner "Bowdoin", WNP, frozen in the ice above Etah, North Greenland, is still on the job and is being heard occasionally, but with great difficulty, and really successful two-way communication has not taken place in about two months. On April 3d, as we write these lines, 7AIB in Port Angeles, Wash., has just wired a report of the reception this morning of a blind broadcast from WNP saying "ALL WELL DAYLIGHT HERE NOW".

At no time since the Bowdoin arrived at winter quarters have we been without some contact with her, but the past month has been even worse than February. No one seems to have entirely reliable information on her signals. True, reports have been received, but nothing in any details of value appear.

In answer to the appeal for a continuous watch for WNP, the gang did just as was expected—turned out in large numbers. Some hundred stations along the northern border and others scattered all over the United States and Canada got vigorously on the job. Probably because of this effort, the reports did start coming in, but no two-way communication was established nor was anything received from WNP other than faint calls or a "CQ", which Mix seems to have resorted to during the month.

On March 9 it appears that WNP called a station (2BD) in Aberdeen, Scotland, and thanked that station for a broadcast program transmitted during the tests with America. The report appears in *Wireless World & Radio Review* for March 19. Canadian 4HH reports working WNP on March 3 when he transmitted three messages to Mix, which were acknowledged. A power leak prevented any reception other than the QSL for the messages. One of our old standbys, 9DKB, heard Mix on March 10, but too weak to read and signals fading badly. 7ADQ says WNP comes thru quite often but weak and fading. 9EFH reports hearing WNP on March 18 —weak and fading badly. 9DOE reports WNP on March 17, very QRZ and fading, but on March 18 he reports her very QSA, with no further details. 9EI logged WNP March 10 very weak and fading. 3HS reports Mix March 23. 8ES reports WNP on three occasions March 30, saying that Mix was calling a 6 or 7.



The California fellows have been equally unfortunate. WNP was fairly consistent there for several months, but lately signals have not been coming thru. 6AKW reports a very QRZ 500-cycle signal which he thinks was WNP, on March 23.

Of course there are many other reports —the gang is on the job—but we haven't taken traffic from Mix for two months and we are wondering whether the trouble is with WNP or whether some other condition has come up of which we know nothing. Be that as it may, the amateur spirit will not let Mix go for long without some contact and while we know there are many stations keeping the nightly vigil, we want to keep this before you until we know just what can be done and when we can be assured of good contact again.

Some reports have been received of chopper signals or pure C.W. from WNP, and the possibility exists that Mix has had trouble with his m.g. and has been using a low-powered set with dry-cell plate supply. Stations are asked to make particular note of the character of signals heard.

—*F.H.S.*

New England Holds Splendid Convention

ALTHO annual banquets have been a feature of First District amateur doings since before the war, and altho for years it has been the custom of the Division Manager to call an annual traffic conference of the O.R.S. men, the first real convention ever held as such in the First was the New England Division A.R.R.L. Convention in Springfield, Mass., March 28 and 29. About three hundred hams from all over the Division and a dozen or so from the Second District attended, and the affair was a genuine success.

It was a hammy, chummy convention, the kind where friendships are made and renewed, a glorious contrast to some conventions we have attended. No business was scheduled for the first day, the afternoon being given over to stunts, a Liar's

Contest, etc. (in both of which the Providence club members carried home the prizes), and in the evening a dance was held at the Hotel Kimball. Yes, an amateur radio dance! Many of the fellows had brot their O.W.'s, and A.D.M. McLean rounded up several dozen of the best looking Y.L.'s in Springfield, so the party was a jolly one. Lee Bates of 1GY and his mean flute added lots of fun.

Radio Inspector Butterworth was there and held examinations the next morning, and there was a trip to inspect WBZ. In the afternoon Traffic Manager Schnell presided at a traffic meeting to discuss operating matters, and a very interesting technical lecture, illustrated with slides, was given by Mr. I. F. Byrnes, General Electric engineer. The banquet was held in the evening, A.R.R.L. Treasurer Hebert acting as Toastmaster. Among the speakers were Division Manager Vermilya, Assistant D.M. McLean, his Executive Assistant Miss Helen Daniels, who is a most charming and efficient young lady, Inspector Butterworth, "Paragon Paul" Godley, Lloyd Jacquet of *Amateur Radio*, H. W. Croucher of *Radio Relays*, J. O. Glennie of Dartmouth College, and Traffic Manager Schnell and Secretary Warner of A.R.R.L. Headquarters. The Second District boys formally presented a bottle of LePage's glue to the convention, with the

The Pied Piper — Lee Bates

hope that the First and Second would always "stick together."

After the banquet the ballroom was cleared and the Worcester crew put on the first Wouff-Hong initiation held in New England, Huddy of 1II being selected to ride the goat. The work was well done and showed much hard work on the part of the Worcester team, who thruout the convention were the life of the party. One of their stunts was the inauguration of the Independent Order of Yellow Dogs, companion order to the A.O. F.L.E., and many hams were taken in as members of Worcester Kennel.

Great credit is due the men of Springfield, particularly A.D.M. A. S. McLean, and the Worcester R.O.W.H. team, particularly Master of Ceremonies L. A. Bates, for their hard and successful work.

—*K.B.W.*

U. S. Civil Service Exams

THE United States Civil Service Commission announces the following open competitive examinations:

JUNIOR ENGINEER (RADIO)

The examination will be held throughout the country on May 7. It is to fill vacancies in various branches of the Government service, at an entrance salary of $1,860 a year.

Applicants must have been graduated with a degree in engineering, preferably in radio engineering, from a college of recognized standing; or must be senior students in such course and furnish within three months from the date of the examination, proof of actual graduation. Applicants who have completed two full years of the engineering course may substitute for each of the additional years, one year of experience in radio engineering.

Competitors will be rated on general physics and chemistry, pure and applied mathematics, practical questions on radio engineering, and education, training, and experience.

ENGINEER—$3800 to $5000 per year.

ASSOCIATE ENGINEER—$3000 to $3600 per year.

ASSISTANT ENGINEER—$2400 to $3000 per year.

Applications received up to July 1st. Positions open at Bureau of Standards, Washington. Applicants may choose from following optional subjects: Electrical Engineering, Mechanical Engineering, Civil Engineering, Chemical Engineering, Radio Engineering, Materials Engineering, Ceramic Engineering. Competitors will not be required to appear for examination but will be rated on education and experience and on information submitted with application.

RADIO INSPECTOR—$2400 per year.

Applicants must have accredited High School education and at least two years experimental special radio work, manufacture, adjustment, installation, operation or maintenance of commercial radio apparatus. Applicants may substitute one year in technical school for each six months of experience and may substitute six months of experience for each year of High School.

Full information and application blanks for the above may be obtained from the United States Civil Service Commission, Washington, D. C., or the secretary of the board of U. S. civil-service examiners at the post office or customhouse in any city.

Capacity and Inductance Measurements for the Amateur

By Frank Reid Stansel

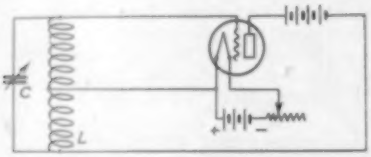
NOW and then the average amateur wishes to measure the inductance of a coil or the capacity of a condenser. Extreme accuracy is usually not necessary nor are precision instruments and standards available. The writer hopes in this article to show how the desired measurements may be made using only such instruments as one may expect to find in the average amateur's possession. Errors as high as 5% in the final result have been tolerated as this degree of accuracy is sufficient for most amateur work, but by careful procedure it is possible to secure final results that are more accurate.

Units of Capacity and Inductance

In the formulae in this article, capacity is always measured in microfarads and inductance in centimeters. 1,000,000 centimeters are equal to one millihenry, consequently 1,000 centimeters are equal to one microhenry.

The Apparatus Used

The necessary apparatus is a heterodyning wavemeter and an ordinary receiving set. Plenty of data on wavemeters have been published recently, but for some reason the heterodyning wavemeter has not been popular. This type of wavemeter is easily handled in conjunction with an oscillating receiver. It has one disadvantage: it uses an extra tube. However, since it is not necessary to use the wavemeter and the receiving amplifier at the same time,



L – 20 turns No. 14 D.C.C. on tube 4½" dia. tapped at center.
C – .0005 μfd. maximum

FIG. 1 – OSCILLATOR CIRCUIT

why not use the same tube for both purposes, taking it from the socket of one and putting it in the socket of the other? Of course, if you have an extra tube, so much the better.

The wavemeter used to obtain data for this article is nothing but a small Hartley oscillator stripped of all unessential parts. No grid leak or condenser need be used but the polarity of the A battery and the location of the filament rheostat must be as shown in Fig. 1. The variable condenser preferably should have a maximum capacity of .0005 μfd. A larger one may be used but the tube will not oscillate consistently through the entire range. A hard tube should be used and the plate voltage may be absurdly low—2 to 4 volts usually will be sufficient. In fact it is easy to make a UV-201 oscillate at sufficient strength by short-circuiting the B-battery posts and using for plate voltage nothing but the small drop across the filament rheostat. When doing this it is well to use a fully charged A-battery so that as much of the rheostat as possible may be in the circuit. A UV-202 will operate in this way but to date no success has been had with a UV-201-A, although it will oscillate readily with 4 volts on the plate. (This is not a mere stunt. In our experience steadier operation is obtained than with the usual 20-40 volt plate supply.—Tech. Ed.)

Calibration

If the wavemeter is to be calibrated from WWV or a similar source, the heterodyning variety has an advantage over any other type. It may be calibrated from one received wave at the announced wavelength and at *half* this value. As most amateurs know, an oscillating tube generates not only the fundamental frequency but a number of harmonics at one half, one third, one fourth, etc., of the fundamental wavelength. Of these harmonics the double-frequency or half-wavelength is strong enough to be useful. Tune the receiving set to WWV and carefully secure a "zero beat". Now start the heterodyning wavemeter into oscillation and tune it to the received wavelength (leaving the receiving set alone) until the heterodyning whistle from it disappears. Under some circumstances there may be a space of one degree in which the beat note is zero; the desired point of resonance is in the center of this space. Usually the adjustment is much sharper. This gives you the setting for the announced wave, as you now have zero beat between the oscillating receiver, the heterodyning wavemeter and the incoming signal. Record the wavemeter scale reading, and, *without changing the*

[1]—Much trouble is caused by careless use of heterodyne wavemeters. The *same* tube, the same batteries and the same connecting wires must always be used, with everything kept in the same position. The best way is to fasten everything including the A and B batteries, solidly on a board, renewing the batteries with others of the same sort when their voltage drops even a little.

receiving set, reduce the capacity of the wavemeter condenser to about one fourth of its former value. You will find another beat note which also should be reduced to zero by carefully adjusting the wavemeter. This point is the setting for one half of the announced wave of WWV. Notice that you are setting to a harmonic of your receiving tube, not to a harmonic of WWV. It is therefore very important to leave the receiver alone while making the adjustment. As to the accuracy of the method, the writer once calibrated a wavemeter at 125 meters from a 250-meter wave and later in the same night re-calibrated directly from a 125-meter wave. The two calibrations agreed exactly.

In addition to the calibration of the wavemeter the calibration of the variable condenser should be obtained. This can usually be obtained from the manufacturers, but if a special calibration can be obtained, so much the better.[1]

Capacity Measurements

Measurements of capacity are very simple. Start the wavemeter and receiving set to oscillating and set them to resonance by the zero-beat method. Now shunt the unknown condenser across the wavemeter condenser as shown at C_x in Fig. 2 and retune the *wavemeter* to resonance, leaving the receiving set untouched. Now read the wavemeter condenser again. The unknown capacity is equal to the difference between the two capacities at which the wavemeter condenser was set.

Inductance Measurements

The method of measuring inductance is somewhat similar. Tune the wavemeter and receiving set to resonance. Read the wavemeter condenser and call this C_1. Shunt the unknown inductance across the wavemeter inductance, as shown at L_x in Fig. 3, and by increasing capacity retune to resonance, without touching the receiving set. Read the wavemeter condenser again and call this C_2. The unknown inductance, L_x, will be

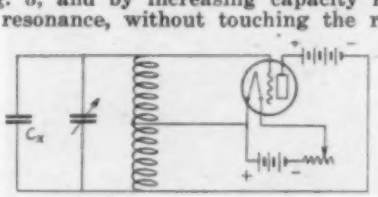


FIG. 2 CAPACITY MEASUREMENT

$$L_x = \frac{K}{C_2 - C_1} \qquad (1)$$

in which K is the value for LC, for the wavelength of the wavemeter at the first setting, and C_1 and C_2 are the capacity of the wavemeter condenser at the first and second setting respectively. If the inductance of the wavemeter coil is known, the value of K may be calculated from

$$\lambda = 59.6 \sqrt{L\ C_1} \qquad (2)$$

or easier still taken directly from an LC table such as found in Appendix 5 of the second edition of "The Principles Underlying Radio Communication."

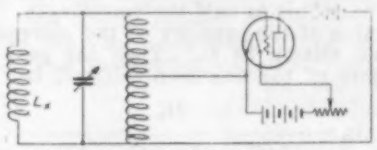


FIG. 3 — INDUCTANCE MEASUREMENT BY METHODS OF FORMULAS 1 AND 3

In Formula 1 the distributed capacity of the wavemeter coil does not have any effect.

Pure Inductance

Sometimes the pure inductance of a coil is wanted. To get this it is necessary to correct for the distributed capacity of the unknown coil. According to the Bureau of Standards' the distributed capacity (in micro-microfarads) is about equal to the coil diameter in centimeters, provided that the coil is closely wound in a single layer. However, this value is not accurate enough to substitute as a correction. Formula 1, corrected for C_d, the distributed capacity of the unknown inductance, would be

$$L_x = \frac{K}{(C_2 - C_1) + C_d} \qquad (3)$$

If the value of $(C_2\text{-}C_1)$ can be made very large relative to C_d (which for the usual type of coils can be estimated as above) Formula 1 may be used, but otherwise a correction must be made. In general, it is recommended that Formula 1 be used if a value of $(C_2\text{-}C_1)$ greater than .0002 μfd. can be obtained. Notice that the greater the difference in the size of the unknown inductance and the wavemeter inductance the larger the value of $(C_2\text{-}C_1)$ will be and the less the error introduced by neglecting C_d. With the size coils necessary on a wavemeter covering amateur waves, $(C_2\text{-}C_1)$ will be greater than .0002 μfd. only for very small values of the unknown inductance, and these facts lead to the suggestion that a larger wavemeter coil could be used and the measurements made on higher wavelengths. Since WWV is now sending calibrated waves up to 2000 meters, some experimenter might try this.

If the value of $(C_2\text{-}C_1)$ is less than .0002

[1]—Such work is done by the Bureau of Standards and by the Washington Radio Laboratories.

μfd. a different method will be necessary. First tune the wavemeter and the receiving set to resonance as previously described. Call this setting C_1 as before. Then shunt the unknown inductance across the wavemeter, reset the wavemeter condenser for resonance as before, and call this setting C_2. Next *decrease* the wavemeter capacity, leaving the receiving set exactly as it was before, and bring the wavemeter in resonance with the receiving set's harmonic at half the wavelength. Let the value of the capacity of the wavemeter at this setting be C_3. Then the *pure inductance* of the unknown coil will be

$$L_x = \frac{3K}{3(C_2 - C_1) + C_3 - 4C_3} \quad (4)$$

and the distributed capacity of the coil will be

$$C_d = \frac{C_3 - 4C_3}{3} \quad (5)$$

It will be noted in these formulas the accuracy of final result is dependent on the accuracy of the reading of the wavelength and of the capacity of the wavemeter condenser. The receiving set is simply used to furnish a constant frequency source of oscillations and any losses in it, except as they may effect the sharpness of the point resonance, *have no effect on the results obtained.* All of the formulas given are theoretically correct. If the distributed capacity of the coil is low enough to neglect, Formula 1 is preferable to Formula 4 since, being simpler, errors are less likely to become cumulative. At the most the error in the final results should never exceed 5%. This error may be made even less by measuring the value of the inductance several times on a different portion of the scale if possible, and averaging the results.

The derivations of the formulae have purposely been omitted. The writer will be glad to send them to anyone interested.

The Second District Holds Forth

FROM March 4th to 7th, inclusive, the Executive Radio Council of the Second District held its annual affair at the Hotel Pennsylvania, New York.

The show, held in the main ballroom, was not vastly different than other radio shows. It was well patronized by the gang and the public, and we understand was quite successful financially. One of its most interesting features, we thot, was the series of club exhibits on the gallery surrounding the floor. Here various of the clubs comprising the Council put on displays. The Bronx Radio Club exhibited their successful Transatlantic receiving station, and with maps and posters put on a very interesting record of their work and an eloquent tribute to the amateur. The Radio Club of Brooklyn exhibited their broadcasting station "WHY", the front bunkboard of which is illustrated in our photograph; note the "wave-trap", the "bottles", etc. The Fink transmitter in the booth of the Radio Club of Long Island was an attractive constructional job.

Aside from the club booths, about the only amateur activity was the banquet on the night of the 5th, and the R.O.W.H. conclave on the 6th. Of the banquet, we fear that the less said the better. Among the good things about it that stick in our memory, however, are Paul F. Godley's very helpful comments on amateur progress, George H. Clark's illustrated account of the activities of the Radio Corporation of Egypt, the funniest thing we have encountered in radio in years; and the announcement by the Council of the award of a medal annually to the amateur making the best technical contribution to the amateur art, the 1923 award going to John L. Reinartz for his development of the short-wave transmitter. About 600 were present, almost all amateurs.

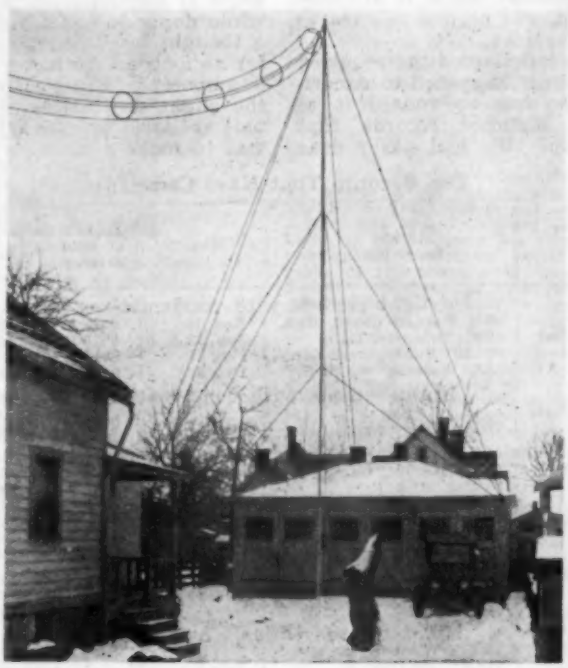
David Talley as Master of Ceremonies staged a very successful Wouff Hong initiation, the Radio Club of Brooklyn being responsible for most of the work. The R.C.B. men deserve all kinds of credit, having had but three weeks' preparation. Dr. L. Dunn was M.O., G. R. Herbert O.M., F. R. Doscher O.D.O., U. D. Ross QRM, T. Wilson QRN, B. J. Fuld I.K.I.A., H. H. Bentman P.A., and D. F. Kirchek M.M., while 2BRB was the vicarious candidate. Congratulations are due the crew for its success in the face of obstacles.

The R.C.B. station, "WHY?" ("Foto Topics")

A Sixty-Foot Featherweight Mast

By C. E. Dengler, 8KS

WHAT a suspicious lot of cusses we fellows are, anyway. A few months ago, in the description of an amateur station in *QST*, mention was made of the fact that the antenna was supported by a mast constructed from ordinary galvanized conductor pipe such as is used to drain water from roofs. Of course everybody said it couldn't be done as this was entirely too thin to support itself, let alone an antenna.



The writer had just finished many long days of work lowering, moving, painting and preparing to raise the old sixty-foot iron mast up into place again, and then just when it had started up nicely the middle section seemed to suffer with cramps and after the writer had taken a good look at the remains the stack of *QSTs* were hauled out and the search started. Then that few lines about the gutter pipe mast, and the old flivver went rambling away as flivvers do. In a few minutes it returned with a bundle of conductor pipe tied to the starboard gunwale.

In a few short hours a sightly mast lay in the yard, ready to raise its head skyward.

The pipe was #26 gauge galvanized conductor pipe. The sections were joined by simply telescoping one piece into another for about 12 inches and then soldering the joint. A tin cap was soldered to the top. The guys from the old pole were fastened on by wrapping around the pipe nad then soldering with a good blow torch.

A set of guys every 20 feet is more than sufficient and will support the mast rigidly.

It is not necessary to go into more detail as no trouble will be experienced if a small part of the brain and brawn necessary to erect a heavy pole is used.

This mast easily supports my 70-ft. cage and has gone through some severe wind and sleet storms without a quivver.

The old mast was made of extra-heavy black iron steam-pipe, ranging from 3-inch at the bottom to 1½-inch at the top, and weighed about half a ton. The new mast stands 58 feet above the ground, perfectly rigid and yet so light that one man could easily carry it when on the ground. There is no more cause to worry about how many of the neighbors' houses will be flattened out if the guys should rust out; and what seemed like bad luck when the old boy doubled up has really proved to be the best kind of luck and I have ridded myself of another white elephant.

So if you need a new pole, bury your suspicions and go to it.

It's sure FB here, OM. I will be glad to give any other information I can to anyone sending a self-addressed envelope for a reply.

(The first of the "tin" masts was erected at old 9DM, Lawrence, Kansas, about 1912. Those at 9LQ followed, then the idea escaped to Kansas City. All of these masts were guyed every 10 feet. The joints were made with the aid of 24" drive-fit sleeves, lock-seamed, from No. 24 gauge material. The ends of the sections were reinforced by No. 22 gauge discs soldered on. The guy wires were passed *through* the sleeves between ends of the sections and soldered. These masts never fell down, and there are *real* winds in Kansas.—Tech. Ed., "LQ").

That "Station Efficiency" Contest and the New American Amateur

By S. Kruse, Technical Editor

Many senseless things are going out of amateur radio. The rubber-stamp-message mania was quietly knocked in the head some months ago. The long-wave outlaws are thinning out rapidly, not because they are learning any better but because their neighbors have made life too miserable for them. Good tuners that really go down thru the amateur band are being built everywhere. Soon we expect to hear that a few CQ hounds have been fried over their own sending tubes by indignant members of the League.

AMERICAN amateur radio, about six months ago, had settled down to thinking that we knew it all now. A hard jolt was needed to cure us of this crazy idea.

Australia 2CM administered the required jolt—nothing that ever happened to American Amateur radio has so roused it as those remarkable distance records that Maclurcan hung up. We had never done anything to compare with that—we very evidently did *not* know all about it.

The Records That Have Come In

Station Sending	Station Receiving	Date	Local time at sending station	Miles Distance	Plate Power: Volts	Plate Power: Mils	Plate Power: Watts	Miles per Watt
Daylight records with confirmations								
9CMY, Emporia, Kan.	9EL, Council Grove, Kan.	Nov. 12	3:15 P.M.	20	25	3.5	0.062	319.
9BOP, Crawfordsville, Ind.	4EB, Palmetto, Ga.	Jan. 13	3:15 P.M.	500	400	70.	28.	17.8
9BOP, Crawfordsville, Ind.	9CLW, Burlingame, Kan.	Feb. 29	8:05 A.M.	500	400	70.	28.	17.8
8CF, Detroit, Mich.	3JJ, Washington, D. C.	Dec. 3	9:00 A.M.	400	—	—	34.50	11.6
Night records with confirmations								
4OY-4RJ, San Juan, Porto Rico	3BDO, Vineland, N. J.	Dec. 9	3:15 A.M.	1500	60	—	—	—
125-meter Canadian night records with confirmations								
3NI, Ft. William, Ont.	4XC, Atlanta, Ga.	—	—	750	45	8.	0.36	2080.
1BQ, Halifax, N. S.	British 2OD	—	—	3000	—	—	20.	150.
1BQ, Halifax, N. S.	3BQ, Kitchener, Ont.	—	—	1000	—	—	0.80	1250.
3BQ, Kitchener, Ont.	1BQ, Halifax, N. S.	—	—	1000	—	—	1.40	711.
9BL, Halifax, N. S.	2BN, Montreal, Que.	Feb. 19	—	700	—	—	1.25	560.
Daylight records without confirmation								
9AHH, Eagle Grove, Iowa	9DES, Caney, Kan.	Dec. 17	12:40 P.M.	80	—	—	.6	133.
5ZK, Franklinton, La.	8DWK, Jackson, Mo.	Dec. 30	9:45 A.M.	400	750	90.	67.5	5.9
5AHD, Altns, Okla.	—	—	—	400	—	—	50.	8.
Night records without confirmation								
8HJ, Elmira, N. Y.	1BVB, Westerly, R. I.	Nov. 9	5:00 P.M.	450	60	10.	0.60	750.
9AHH, Mankato, Minn.	9DQU, Decatur, Ill.	July 8	—	400	60	8.5	0.51	782.
6AWS, San Francisco, Cal.	7MN, Ketchikan, Alaska	—	—	1000	400	40.	16.	62.5
6AWS, San Francisco, Cal.	6CEU, Honolulu, Hawaii	—	—	2200	400	40.	16.	130.
6AWS, San Francisco, Cal.	8BDA, Parkersburg, W. Va.	—	—	1300	400	40.	16.	81.2
7AIB, Port Angeles, Wash.	WNP, Etah, Greenland	—	—	—	—	—	35.	74.
3SM, Philadelphia, Pa.	Pacific Ocean	—	—	6500	—	—	165.	39.4
5HT, Ft. Worth, Tex.	7MN, Ketchikan, Alaska	Dec. 28	6:00 A.M.	2270	1700	300	510.	4.5
5HT, Ft. Worth, Tex.	6CEU, Hawaii	Dec. 26	3:35 A.M.	3200	1700	300	510.	6.3

Other records that were submitted cannot be used for one of the following reasons. Either the tube equipment was mentioned without giving the actual input in watts, the wavelength used was illegal, or no statement was given as to the station worked. Stations submitting such records were 9CPO, 9CKT, 4IU, 5SR, 1CMP, 6AJF, 1AWN, 5AIP, 7BJ, Canadian 5GO, Canadian 3WS, and some additional material from Canadian 3BQ; also Harry Wilkensham, call not known.

American Amateur Radio Wakes Up

American amateur radio sat up and began to think—if we had been beaten so badly there must be a reason. What was the reason?

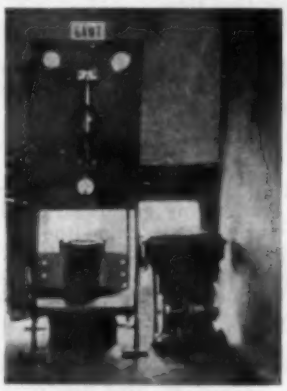
The answer is very easy—we had *wasted* years in trying to see how powerful we could make our stations, and hadn't learned much of anything about radio transmitters while doing it. Most of us had not given a thought to efficiency—what did that matter as long as the meter went clear over to 6 amperes? Practically none of us paid the slightest attention to making the signals *readable* or *steady;* no, the main idea was to make a *noise.*

We said at the head of this article that a lot of foolish things had passed out of amateur radio.

Now it is the turn of the "ether buster", the "watt burner", the lad whose ideal in life is to wreck the antenna ammeter.

In the place of this pest we will have the New American Amateur, whose ideal is not a *big* station, but a *good* station,

who does not care how far his station reaches but who will try to make it perform as perfectly as possible. Such a station will be on legal waves *always*, it will transmit a clean-cut steady signal that does not waver or wobble, and it will have an antenna that stays put thru storm and



The Big Bottle That Burns 700 Watts as 6AWT or 16 Watts as 6AWS.

sleet. In the future the question will be —as the ad. men say—"Not how much, but how good."

Starting in the Right Direction

That isn't idle talk—it is straight fact. The interest in loose-coupled sets is increasing, we hope that the direct-coupled ones will be outlawed soon. And certainly there is no end of interest in the business of working better distances with low power.

Steady Waves

At least half of the men submitting logs say that their success with low power is due mainly to a good tone and a steady wave, secured by running the tubes conservatively.

Operation

Four of the men also point out that in low power work it is particularly necessary to call in an orderly fashion. No one will listen to a weak signal that makes 164 calls before signing.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of *QST*, published monthly at Hartford, Conn., for April 1, 1924.

State of Connecticut } ss.
County of Hartford }

Before me a Notary Public in and for the State and county aforesaid personally appeared K. B. Warner, who, having been duly sworn according to law, deposes and says that he is the business manager of *QST* and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The American Radio Relay League, Inc., Hartford, Conn.; Editor, Kenneth B. Warner, Hartford, Conn.; Managing Editor, (none); Business Manager, Kenneth B. Warner, Hartford, Conn.

2. That the owners are: (Give names and addresses of the individual owners, or, if a corporation, give its names and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock). The American Radio Relay League, Inc., an association without capital stock, incorporated under the laws of the State of Connecticut. President, Hiram Percy Maxim, Hartford, Conn.; Vice-President, Chas. H. Stewart, St. David's, Pa.; Treasurer, A. A. Hebert, Hartford, Conn.; Traffic Manager, F. H. Schnell, Hartford, Conn.; Secretary, K. B. Warner, Hartford, Conn.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are. (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear on the books of the company but also, in cases where the stockholder or security holder appeared upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe than any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ..... (This information is required from daily publications only.)

Sworn to and subscribed before me this 17th day of March, 1924.

K. B. Warner.

F. L. Pratt, Notary Public.

(My commission expires February 1, 1929.)

Experimenter's Section Report

AT the time that this is in the hands of our members the long-promised letters giving details about the Experimenters Section will have been received by all those who signed up.

We have been very agreeably surprised at the large number and the excellent equipment of the laboratories which have offered their assistance. Amongst the men who have signed up for the Experimenters Section are some notables both in this country and abroad.

The intention is not at this time to initiate a complicated organization. We feel that the less organization there is, the better everything will operate. Our purpose is, as stated in the beginning, to act as a sort of clearing house between various experimenters, putting into touch with each other those men who are working on the same problems and presenting to the readers of *QST* whatever valuable conclusions may be arrived at.

Concerning Correspondence

Because the enrollment has been so much beyond expectations it follows that for a time correspondence will not be handled as promptly as we would wish. This will be remedied as rapidly as possible and all helpful suggestions will be very much appreciated indeed.

Current Work

One of the questions being worked on right now is the business of low-loss tuned circuits. This is being gone at from a number of angles and we will be pleased to put in touch with each other all of those who are interested in the following subjects:

Most desirable material for condenser insulation.
Best disposition of this material.
The effect of frequency upon condenser resistance.
The effect of tube material and thickness upon coil resistance.
The effect of insulation and varnishes upon coil resistance.
The necessity for keeping coils away from metallic and insulating materials in the set.

It is impossible to go into the matter in more detail and it is requested that those wishing to do any specific work, or now engaged in that work, write us as to the people with whom they would like to be put in touch.

Transmission Experiments

The experiments conducted last summer at 8AQO have now been partially calculated and it is believed that some useful information has been gained regarding the improvement of transmission as the wavelength is lowered for any given antenna. To prevent repetition, we will be glad to make suggestions to those who wish to work along this line.

Circuits which will be freer from key thumps, harmonics and the like, are in popular demand. There is much room and need for work on transmitters that will be very much superior to the things now in use by amateurs.

Filters

The filter question has not been satisfactorily settled for generators. Some additional work along this line is needed. One of the leading manufacturers of high voltage generators is now doing such work and will be pleased to hear of others who are interested.

Rectifiers

The electrolytic rectifier is still receiving attention. Three or four different lines of attack are now being followed by experimenters in this Section in three different countries.

The mercury arc rectifier is also receiving some attention and four of our experimenters are now working on it. Others are requested to write.

The synchronous rectifier has not performed satisfactorily in the past. Truly satisfactory filtering has not yet come to our attention. Several experimenters are willing to work on this matter if a reasonable line of attack can be suggested.

Counterpoises

The counterpoise is not at all well understood. So much remains to be done on it that the problem cannot be stated in this limited space. A circular letter of suggestions is available.

Special Coils and Helices

Very little seems to be known about helices. Rough experiments made recently indicate that for amateur work the so-called "pancake" of straight strip offers the best possibilities. It is possible in part to calculate the resistance of such coils but experimental checks are very much needed. Anyone having equipment for precision measurements of this type can assist greatly.

Power-Line Interference

A variety of methods for locating sources of interference on power lines has been suggested. We would like to hear of fields where they may be tried out, always being sure to mention someone who will be willing to do the work.

Dead Spots

A collection of information upon dead

spots is slowly being made. The response of the membership has been quite unsatisfactory so far, although some excellent replies have been received. The intention is to accumulate enough reports to gain some satisfactory bases upon which to plan a possible experimental investigation. Nothing active can be done unless many more reports are received. All members of this Section are therefore urged to get from their neighbors as many such reports as possible. For the present all that is needed is a statement of the location of dead spots, preferably indicating the wave lengths which were used. Address these to the Technical Editor.

Megger Available

Several meggers are available for measurements of extremely high resistances, such as insulation resistance. Anyone having a problem along this line should communicate with us as it may be possible to put him in contact with the owner of a megger. However, these usually are available in the laboratories of electric lighting companies.

Lunar Observations

For some time there has been an increasing feeling that radio transmission is affected by the moon. Some data are already available and those desiring to make systematic observations will find them of interest.

Receivers for C. W.

We have received two interesting suggestions as to possible methods for increasing the sensitivity of a continuous wave receiver. These methods are probably not useful for anything else.

They could best be attacked in a laboratory equipped for tube experiments.

Audio Amplifying Transformers

We are very anxious to get into contact with someone having experience in the design of audio transformers. The object is the creation of an audio transformer which shall give maximum amplification at 1000 cycles and drop rapidly to both sides. Such a transformer will be quite useless for telephony but will be ideal for signal work.

Short Wave Transmission and Reception

We have on hand a considerable list of station owners who desire to make particular tests on short waves, mainly below 90 meters. Others interested in this same thing may have the list on request.

Daylight Tests

We also have a brief list of stations which desire to make daylight tests, mainly at noontime. Some of these stations are operating on standard amateur waves, others are special licenses.

Comment and Suggestion

Members of this Section are invited to comment freely upon the problems that we should take up and the way in which they should be attacked. In doing this please take note that those problems relating purely to the traffic handling are not within our province but should be referred to the Traffic Manager.

—The Technical and Department Editors.

Affiliated Clubs

THE A.R.R.L. takes pleasure in announcing the affiliation of the following radio societies at a meeting of its Board of Directors held March 8, 1924:

Haverford College Radio Club, Haverford, Penna.
The Radio Club of the Boys Club, New York, N. Y.
Universal Radio Club, Bayonne, N. J.
Bronx Radio Club, Bronx, New York City.
Indianapolis Radio Club, Indianapolis, Ind.
The Phillips Exeter Academy Radio Club, Exeter, N. H.
Tulsa Council of the American Radio Relay League, Tulsa, Okla.
West Gulf Radio Club, Enid, Okla.
The Commonwealth Radio Association, Boston, Mass.
Downtown Radio Club, New York, N. Y.
Telephone City Radio Association, Brantford, Ont.
Glenville High School Radio Association, Cleveland, Ohio.
The West Hi Radio Club, Cleveland, Ohio.
Amateur C.W. Association of Spokane, Spokane, Wash.
Stanford University Radio Club, Stanford Univ., Calif.
The Citizen Radio Club of Omaha, Omaha, Nebr.
Associated Radio Operators of Denver, Denver, Colo.
Armour Radio Association, Chicago, Ill.
San Diego Radio Club, San Diego, Calif.
Dickinson Radio Club, Dickinson, N. Dak.
Radio Club of Long Island, Richmond Hill, L. I.
The Northern New Jersey Radio Association, Ridgefield Park, N. J.

An Amateur in the Lighthouse Service

OUT in the middle of Lake Superior, forty-five miles north of Marquette, Michigan, is Stannard Rock Light. The lighthouse itself is located on a submerged rock and is of massive reinforced concrete construction, built to withstand the worst of the winter storms. In order that the attendants would not be isolated from the outside world for weeks at a time during rough weather when no landing could be made, a small radio telephone set was installed at the lighthouse and another on shore at the Marquette lighthouse. This was early last summer. Not much success was had in working between these two stations, however, because trouble was experienced in covering the distance and it was not possible to keep a regular operator at the Marquette station.

STANNARD ROCK LIGHT, from which Mr. Wesser operated NASK during the month he was stormbound there. The vertical antenna, 47 feet long, can be seen at the right. The light itself is 101 feet above water level.

During October, C. H. Wesser, who is the central figure in this story, prepared to install two larger transmitters for use at the Stannard Rock and Marquette lighthouses so that reliable telephone communication could be assured. Each of these new sets employed three 50-watt tubes; an oscillator, a modulator, and a voice amplifier. By the first of November all was in readiness to make the trip to Stannard Rock Light with the new set. Mr. Wesser writes as follows:

"Before leaving Marquette a schedule was made with Mr. R. S. Rose, 9DRR, in Marquette, Michigan, so as to have some one to test with and to communicate with in case anything might happen while out at the "rock", for there would be no other communication with shore until around the 5th of December when the lighthouse tender would come out and take us off.

"After a miserable trip in a 38-foot launch the Stannard Rock was reached and a landing made after some difficulty. I found the old set I installed last summer still there just as I had left it, and to my surprise it still worked. It put 1.7 amperes into the antenna so the next noon I was able to work 9DRR, who came back with "QSA, F.B". During the next few few days I tried running the new 500-watt motor-generator off of a gas - engine - driven D.C. generator but the big M-G was too much for it. This halted the work of installing the new transmitter so I immediately prepared to go ashore. This was easier said than done, however, for the wind had picked up so that lowering the launch which was laid up on the pier was impossible. We must wait for a calm day. The day did not come until the 22nd of November.

"Had it not been for that small transmitter, and all the amateurs I worked, particularly 9DRR, I believe I would be in an insane asylum today. 9DRR gave me news and weather reports every day, handled traffic for our office, and if he could only have sent us something better than tea leaves to smoke, life would not have been so bad out there on the "rock" 45 miles from nowhere. Outside of 9DRR one other station, 9ZT, deserves credit for sticking to the schedules I made with him. He was worked dozens of times, even after sunrise, and quite a few messages handled.

"Reception out there was exceptionally

(Concluded on page 64)

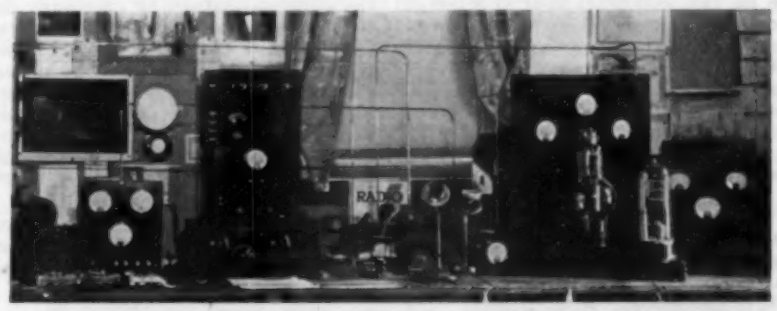
Daylight Transcon at Last

6XAD and 2ADM Work Thru the Sunrise

On the morning of January 12th 6XAD, of Catalina Island, Calif., and 2ADM of Schenectady, N. Y., held a chat by radio. At 6:36:30 A. M., Pacific time, they ran out of conversation and signed off. Neither one of them realized that they had made history—it wasn't till weeks afterward that accidental reference to the almanac showed that on the 29th the sun had risen on Catalina at 6.29—and that the daylight transcon jinx had been beaten at last!

ALTHO the final accomplishment of daylight Transcontinental amateur work came when least expected there was nothing accidental about it. Much work had been done on the problem and the story of this work makes interesting reading.

In the past six months many an amateur radio man has crawled out in the chilly hours of Sunday morning to "work thru the sunrise". The idea has been to connect with a distant station before sunup and then to work as far into the day as possible. In many cases the results were so good that stations tried noonday schedules and worked surprising distances on the standard amateur waves.



6XAD, Major Laurence Mott, Catalina Island, Cal.

2ADM, Ernest Hobbs, 757 Chrisler Ave., Schenectady, N. Y.

Daylight Transcon Attempts

Soon several groups of stations attempted daylight transcontinental relays. Much of this work was done on special wavelengths, which barred stations not having "X" licenses. Because of this, and also because the standard waves seemed to be harder to get over, one string of stations was formed to make the attempt with waves *above* 176 meters. Originally the string was—1OA-1HX, 8AGO, 9AOG, 5XV, 6XAD. After a few weeks this had simmered down to 1HX-1OA, 9AOG, 6XAD, with occasional help from 3APV, 8VE, 9AAW, 9EHT, 5XV and 5XD.

For months this string of three stations connected up four mornings a week at about 6:30 A.M. (Eastern) and worked until signals faded out. If keeping at it would win, this string should certainly have worked—and several times it *almost* did. One morning 1HX-1OA worked 9AOG until 8:51 (Eastern), and that had to be the

morning 6XAD was out of power. On another day 6XAD and 9AOG were QSO until 10:03 A.M. (Central), and that was the day there was a savage power leak in Hartford. Dozens of mornings things went beautifully until 90 minutes after sunrise at Hartford—then contact with 9AOG always broke. With the same tiresome regularity contact between 9AOG and 6XAD broke 90 minutes after sunup in Lawrence.

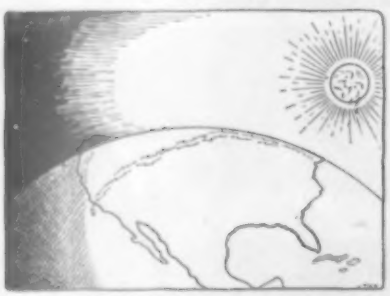
A few tests showed that this sort of thing could be dodged by getting down to 70 meters—*but that wasn't the game.*

Finally 1HX-1OA-1XAQ had to be dismantled and the tests stopped, with nothing to show but 200 pages of detailed logs about sunrise signals, and a record of many messages handled.

6XAD and 2ADM put it Across

In these tests 6XAD had been the strongest station by far, and Mott kept at it after the relay string was abandoned. One eastern station after another was tried and finally 2ADM of Schenectady, New York, was picked on as being the most promising. A number of tests were held but always communication failed at the critical moment when the sun appeared.

On the morning of January 12th no real test was made—the conversation was perfectly casual, and neither operator paid much attention to the time. At 6:36:30 they ran out of talk—and quit. They seem to have lost faith in the chance of beating the daylight handicap, and neither one



seems to have noticed that they had actually done it. Imagine their astonishment and delight when later inspection of the almanac showed that they *had* actually done it—had actually "worked thru the sunrise".

Just Keeping At It

The thing wasn't done by sneaking down below 150 meters; there wasn't anything freakish about the apparatus used. Both stations used their regular wavelength—2ADM at about 195 and 6XAD at 230 meters. We don't know just what power was used at Catalina but 2ADM used only a pair of UV-202 tubes running on 750 volts kenetron-rectified supply and generating an antenna current of 1.2 amperes.

A New Mark To Shoot At

In all of the League's Transcontinental tests it has been the rule that the day extended from sunrise to sunset. Therefore the 2ADM-6XAD record must be accounted as real daylight work. But it is pretty generally known that the full effect of daylight does not take place at once; good radio conditions last some time *after* sunrise and they start some time *before* sunset. It will be interesting to see if we can put a test over at *noon.*

Now it isn't noon all over the U.S.A. at once; we have a 3-hour time-difference to allow for. Before doing this it will be worth while to look at our past experiences. In the 1HX-1OA, 9AOG, 6XAD tests some things were learned. By months of careful logging we found that real daytime conditions follow about 90 minutes behind the sunrise—excepting on cloudy days when they are sometimes 120 minutes behind. On ordinary days the very best west coast signals are received about 19 minutes after the sun gets entirely clear of the horizon, altho this may be delayed 20 minutes on a cloudy day. After that the signals begin to die down slowly and at the end of the 120 minutes mentioned above there seemed to be full noontime conditions.

Tests up and down the coast gave results of the same sort but the time was shorter. The signals then went out 35 minutes after sunup and they went out very suddenly at that.

The same thing appears to happen in the Central time belt.

To make sure that we are working under middle-of-the-day conditions we will allow 3 hours at both ends of the day.

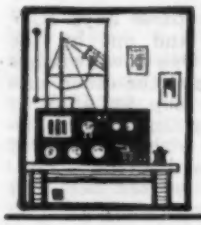
About the latest west-coast sunrise is at 7 A.M., sometime during January. With our 3 hour allowance this means that a full-daytime test cannot start until 10 A.M. Pacific time. At about 1:30 P.M. of the same day (we are still talking Pacific time) the sun will set on the New England coast and the test-day is over. With our three-hour allowance this means we must stop at 10:30 A.M., Pacific time.

That brings about the rather foolish requirement that the message must get over and the reply be returned between 10:00 A.M. and 10:30 A.M. Pacific time or in other words between 1:00 P.M. and 1:30 P.M. Eastern time.

Of course that's making it too rigid and no one will object to a midday record that is made in any time between 9:00 A.M. and 11:30 A.M. Pacific time (in other words, between noon and 2:30 P.M. Eastern time), just so long as it is done on a *standard amateur wave* so that all hands have a chance.

We can name three stations that are going to try it.

—*S.K.*



Amateur Radio Stations

Wallace Wins 1923 Hoover Cup

A General View of 9ZT-9XAX

DONALD CLAIRE WALLACE, of 9ZT-9XAX, Minneapolis, has been adjudged by the A.R.R.L. Board of Directors to have the best all-round home-made amateur station amongst those entered in the competition for the 1923 Department of Commerce Cup. This trophy, commonly known as the Hoover Cup, is an annual award of merit established by Secretary Hoover for the duration of his administration, and is awarded under the auspices of the A.R.R.L. It is one of the highest honors in Amateur Radio, and Wallace wins it fairly after years of hard work. E. L. Lester, 5NK, Houston, Texas, was runner-up in the estimation of the judges.

It is difficult to appreciate the amount of hard work and stick-to-it-iveness required to build and operate an amateur station which, after the test of a year's time, is adjudged "the best". Hence it is very fitting that Mr. Wallace describe 9ZT and tell its history and accomplishments in his own words.

A DESCRIPTION OF 9ZT

By Don C. Wallace

Station 9ZT is the near realization of a lifelong ambition; namely to have a workable and useful amateur station. Compromises have had to be made; compromises between efficiency, practicability, workability, time of construction, and pocket book. It is part of the obligation of an amateur to have his station always in commission, somehow, some way. His masts may blow down, transformers burn out, and minor mishaps occur. 9ZT has been in commission always. Scarcely has any day gone by in the entire twelve months that this has not been true.

The entire set, in so far as is practical, was made by the operator himself. The station is operated by one man almost entirely. In a five-room bungalow, one bed room is designated as the "Radio Room". It likewise serves as a sewing room, nursery, and guest room. When visiting "hams" operate, they can "turn in" to finish the night in peaceful sleep.

The question has often been asked where the time for operation comes from. This was planned for long ago: first by selecting a location close to work, just one and one half miles from the center of downtown Minneapolis. The electrical efficiency of the station suffered thereby, but it was

this or no radio at all. A "flivver" allows the extra half-hour sleep in the morning and saves a half hour at night. By going to bed at nine, going to sleep promptly and getting up sometime after midnight for two hours, an average of eight hours sleep per night is had which helps in fitness for the day's work.

The Transmitter

The transmitter utilizes one 250-watt

Fig. 2—The Plate Supply, In The Basement

Radiotron tube and the Hartley circuit. Simplicity exists thruout the entire layout. Extra apparatus is not connected in or near the circuit to add to the many losses which we know already exist.

Figure 1 is a general view of the station, with the transmitter at the right. The panel originally housed a set using two 50-watt tubes and in those days ICW and phone were cut in and out by the small D.P.D.T. switches. One now switches from high to low power, and the other cuts in a 1½ turn absorption loop for ICW or phone. The transmitting inductance behind the panel is wound with 33 turns of No. 9 wire five inches in diameter. Concentrated inductance has proven best, for though it gets hot, it delivers more antenna current than the larger inductances that now rest peacefully in the attic.

The tube is mounted so air will freely circulate about it. This allows an input 20% greater than could otherwise be used. The grid circuit is short, the UC-1806 .002-microfarad grid condenser being suspended in midair. A 200-turn honeycomb coil as a radio frequency choke is connected in series with the grid leaks as shown in the diagram. Four 5,000-ohm grid leaks are connected in series-parallel, giving an effective 5,000 ohms. The grid current meter, which in normal operation shows about 10 percent of the reading of the 0-500 plate millammeter, is a Jewell 0-100 milliampere meter. The filament is heated from a Thordarson 300-watt transformer. The voltage developed was only 10.5 so additional windings were slipped around the core, care being taken to balance each side of the mid-tap. The filament voltage is maintained constant by a bakelite extension back of the key using

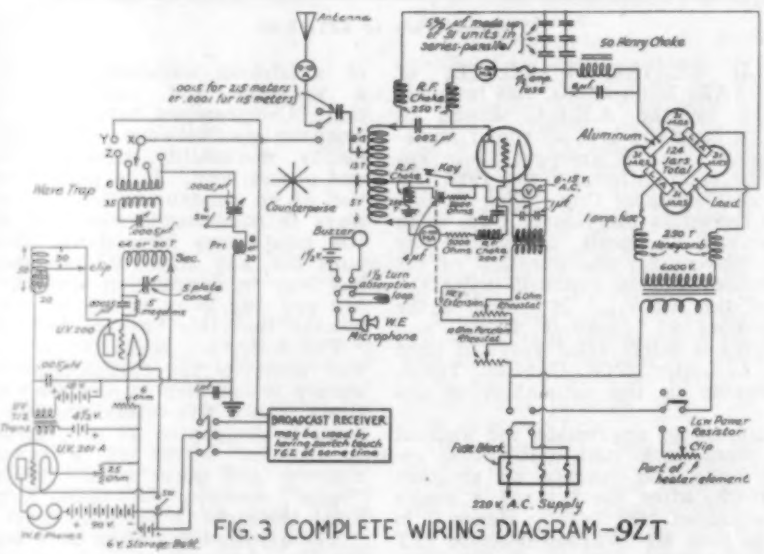


FIG. 3 COMPLETE WIRING DIAGRAM—9ZT

"dime" contacts. The contacts on the extension short-circuit a resistance of a few ohms that is connected in series with the primary of the filament transformer when the key is down. Another feature of the

set is an anti-key-clicker. The combination shown in the diagram has a negligible click compared with the commonly used 1-microfarad condenser across the key.

The antenna ammeter is mounted at the center of the window pane to the right of the picture, through which the lead-in enters. It is a Jewell 0-12 thermo-ammeter and when the key is down the needle hovers between 12 and the stop beyond. All meters and tubes are in clear sight of the operator; one glance tells all, and this feature has no doubt saved the tube on several occasions. The antenna and counterpoise leads are of ⅜-inch copper tubing, polished.

The send-receive switch at the lower left-hand corner of the transmitter panel is of the quick-throw type, connected as shown in the wiring diagram. By slowly pulling the switch the filaments are first heated; then the antenna connected to the transmitter, and the plate power put on. For receiving, the switch is simply pushed in.

It has been found poor policy to change waves, and except in rare instances, only two waves have been used; 215 meters and 115 meters. Those who wish to communicate with 9ZT can count on finding him on the same wave day after day. A General Radio wavemeter, special type, 75-2000 meters, is one of the most useful pieces of apparatus around the station. The antenna current is six amperes on 115 meters. Several months ago 9ZT secured permission to use low waves, but the last week in December 9XAX was received as a call for this work.

Plate current is furnished by a transformer-rectifier-filter system in the basement directly beneath the radio room. This apparatus is shown in Fig. 2. Radio-frequency choke coils, mounted on the back of the transmitter panel upstairs, isolate the set itself from the power supply. Each of the two choke coils is made by winding 250 turns of No. 28 D.C.C. wire on a cardboard tube 4 inches in diameter.

The plate transformer is an old 3-kilowatt line transformer saved from the junk man. About 3500 to 4000 volts are applied to the plate of the tube. The electrolytic rectifier has 124 jars, and needs little attending. The submerged area of lead is 2 by 3½ inches, and the submerged area of aluminum is 1½ by 3½ inches, the strips being six inches long in each case and bolted together. Once every eight months new aluminum is inserted and the solution is changed once in four months. The solution for the rectifier was all mixed at one time in a tub and consists of ten gallons of Chippewa Battery water with two pounds of "20 Mule Team Borax" dissolved in it and a teaspoonful of household ammonia added. After all settlings had gone to the bottom, the jars were filled.

The filter system consists of 5⅜ microfarads of condenser across the high voltage line with a trap consisting of a Radio Corporation UP-1654 choke with 8 microfarads across it connected in the positive lead ahead of the other condenser. The condenser across the line is made up of 51 UC-490 condensers in series-parallel, three in series being placed across the line.

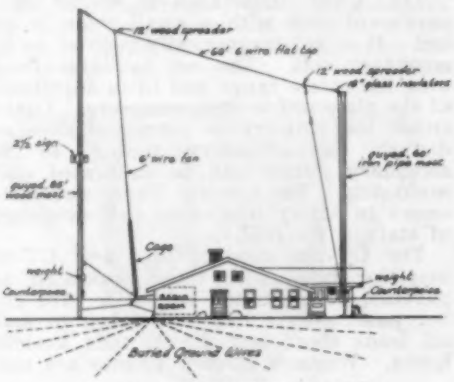


FIG. 4 THE ANTENNA AT 9ZT

In the upper left-hand corner of Fig. 2 can be seen the storage battery for the receiving set and the rectifier for charging it.

The Receiver

The general view of the station (page 43) shows the receiving equipment quite well. It will be recognized as a "low-loss" tuner, designed for selectivity, efficiency, and simplicity in operation. Such a receiver was the only answer to working through local interference, for there are many radio stations in a community such as the Twin Cities. A coupled wave-trap assists in weeding out stray key clicks and other interference. The sending antenna is used to receive with, although a single-wire antenna is often used. The wiring of the complete receiver, which includes a stage of audio amplification, is shown in the diagram.

A basket-wound coil of either 7 or 21 turns is used in the antenna circuit. When the larger coil is used the antenna circuit is tuned by means of a General Radio type 247 condenser connected in series with it. With the smaller coil it is left untuned. The secondary circuit of this set consists of a basket-wound coil with a Cardwell condenser, cut down to five plates, connected across it. The three rotary plates are cut so as to give a uniform wave-length increase as the dial is turned. The wave-length range with a 64-turn secondary coil made of No. 17 wire is from 135 to 235 meters. When a 30-turn coil is put in place of the larger coil the wavelength range is from 65 to 135 meters. An 18-

turn coil goes down still lower and 1XAM has been worked on 56 meters with ease. The primary and secondary coils can be seen in Fig. 1, suspended from the wooden rod in the left of the photo.

The plate inductance is wound on a cardboard tube with a small rotor in one end. It is not magnetically coupled to the secondary coil. The set oscillates freely over the entire range and little adjustment of the plate coil is ever necessary. Tuning either the primary or plate coil does not disturb the secondary tuning, so the secondary circuit can be calibrated quite accurately. The General Radio wavemeter comes in handy in finding the wavelength of stations received.

The UV-200 detector tube and UV-201 amplifier tube, with their associated apparatus, are mounted behind a hard rubber panel. Care has been taken to make all leads short and direct, thus avoiding losses. Western Electric phones are used.

The Antenna

Figure 4 is a general view of the antenna system, showing the arrangement better than the photograph, Fig. 5. All dimensions will be apparent from the drawing. The 85-foot wooden mast is very sturdy and well-guyed. Previous to the time it was erected 9ZT lost two masts in Minnesota storms, so this one was put up to stay. (The description of this mast, with the story of how it was put up, single handed, is a story in itself. We will tell about that later.—Dept. Ed.)

The flat top is of six wires, each sixty

Fig. 5—The Antenna At 9ZT

feet long. The wires are 7-#22 enameled and stranded, on 12-foot wooden spreaders. Eighteen inch plate glass insulators are used throughout the antenna and counterpoise system. There is one of these at each end of the antenna where the halyard joins the flat top. These insulators are a feature of the station that cannot be overlooked and their construction is illustrated in Fig. 5. The rubber bushing is omitted in the counterpoise insulators and those used to guy the lead-in. Using a broken three-cornered file, a brace, and

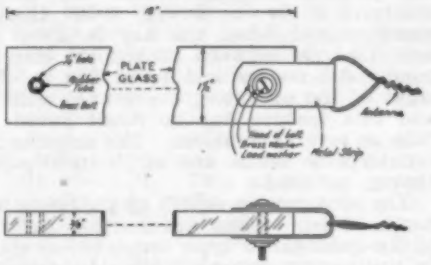


FIG 6 18" GLASS INSULATORS USED AT 9ZT

plenty of turpentine, the glass is drilled very easily.

This antenna was put up nearly a year ago and has withstood all storms since that time. The counterweight at one end lessens the strain on the system. A heavy wind storm will raise the weight, lessening the strain on the antenna, and sleet cannot break it down. The pulley line is flexible galvanized steel cable and will not freeze to the block as readily as rope.

The counterpoise has 23 wires and is more or less radial in shape. It is made mostly of cast off wire, the remains of earlier antennas. Arranged like the spokes of a wheel with the station at the hub, the covered circular areas is about 170 feet in diameter—thanks to the kindness of the neighbors. The 18-inch plate glass insulators mentioned above are used thruout. All joints in both the antenna and counterpoise are carefully soldered.

9ZT's "DX" List

9ZT's signals have been heard in Alaska, New Zealand, Australia, Hawaiian Islands, Mexico, Panama, South America, Porto Rico, Cuba, England, France, and aboard WNP. Stations in every Province of Canada and every state of the Union have been worked. WNP has been worked, and also French 8AB, the latter by the process of 1XW acting as the receiving station, relaying 8AB's transmission to 9ZT.

One Sunday morning seven districts were worked after arising at six. 5ZA at Roswell, New Mexico, was worked after 8:30 A.M., broad daylight at both places, and the distance was 1200 miles. Stations on the West Coast have been worked as early as 5 P.M. their time. All U.S. districts have been worked in one night, and up to eleven different districts, including Canadians of course, have been worked in a single night. On 115 meters,

using the call 9XAX, 1XAM is worked night after night. One year ago 1QP was worked night after night on 200 meters with the regularity of inter-city communication. That reliable work can be done in the summer time was proven when 9ZT worked 47 West Coast stations during last May. Stations on both coasts are worked consistently and regularly the year around. Examination of the station records and log confirm these records and show the remarkable consistency of 9ZT's signals.

Traffic

Exactly 2500 messages passed through 9ZT during 1923. Of these 1187 were sent and 1131 received. The lowest and highest number of messages handled for any one month was 106 in July and 308 in March, respectively.

A complete file of all messages is kept in the attic. Those for each month are kept in a separate bundle with the totals as checked and counted. Few realize the ease by which records of this sort can be kept. The routing of every message handled is known, where it was received from, date and time, where it was sent, delivered, or mailed, date and time.

A sample message, (taken from the files) is as follows:

"6KM 1 8/28 Stockton, Calif.
Mrs. Vic Adams Olney Ill RFD
Greeting from your son by radio
Kenneth
442 A
1 9BBC 740 P 8/28

It will be noted that there is no excess writing, yet the full story is told. Received from 6KM, number 1, August 28th, from Stockton, Calif. Received at 4:42 A.M. Sent to 9BBC as number 1 at 7:40 P.M. the same day.

All messages are written in pencil on a standard size of note paper with this simple, yet effective, data on them. Inexpensive blanks do not tend to reduce traffic as costly printed blanks are likely to do. When sending messages the time and date sent and other information is put on one message with a pencil in the left-hand while the next message is being sent, thus losing no valuable time.

The seven hooks in Fig. 1 on the wall are for messages and are labelled from left to right; N, S, E, W, St. Paul, Minneapolis, and File. Traffic is placed on the proper hook just as soon as received.

It is hoped that this brief resumé of an effective system of traffic handling will help others in our A.R.R.L. to improve without added burden.

The Station Log

Few stations keep a log that is easily interpreted for the entire year. 9ZT's log has been kept complete for the whole twelve months, and therein lies its value. The log is kept in pencil in a ledger book. The time and date is indicated at the left-hand end of the line. The station call heard is next to the right, and then the call of the station he is calling. Because of the large easy-tuning secondary dial it is a simple matter to write the dial setting after the call of the station heard. This is often

The 1923 Hoover Cup, Won by 9ZT-9XAX

done and is a great aid in locating a station at some future time. When a station is worked, the call is underlined or 9ZT written opposite it. A notation such as "sent 2" or "recd 3" on the same line indicate the amount of traffic handled.

The log at 9ZT is a help rather than a burden because it is kept up to the minute, accurate, and complete. It helps wonderfully in the operation of the station.

Acknowledgment

9ZT feels indebted to *QST*, Ballantine's "Radio Telephony for Amateurs", Prof. C. M. Jansky, Jr., M. G. Goldberg, C. K. Fulghrum, F. H. Schnell, S. Kruse, K. E. Hassel, L. E. Dutton, and many others for the numerous suggestions that have been worked out for the betterment of the station.

Who's Who in AMATEUR WIRELESS

L. W. HATRY, 5XV

L. W. Hatry is the fellow who brought radio to Port Arthur, Texas, the town "where the oil and water mix." That he is a radio man there is no question, for look at the crease in his coiffure, where the head phones fit!

Previous to 1918 his life was uneventful and playing Indian and cowboy were the main methods of relieving the monotony. Also a bicycle. In 1918 the general placidity ended and chaos began, for radio bit him that year. The trusty bank was pried open, the six month's savings taken out, and eighty cents worth of "No. 14 hard drawn" was ordered. Thus in an honest manner did station 5XV have its beginning. Since then Mr. Hatry has worked at several radio and electrical

(Concluded on page 57)

MAURICE G. GOLDBERG, 9APW-9ZG

Maurice G. Goldberg was probably the first to upset the old idea that anything we might choose to put on the plates of our transmitting tubes could be changed to pure D.C. by a two-henry choke and a one-microfarad condenser. He saw that most of us who claimed we had filters on our plate supply were just kidding ourselves and set about to prove it. The article entitled "A Study of Filter Systems for Transmitter Tube Supply" which appeared on page 14 of *QST* for April, 1923, was the result. Since then he has been experimenting with loose-coupled tube transmitters and has unearthed some valuable and interesting information on that subject which appeared in a recent *QST*. Mr. Goldberg is one of the few amateurs who

(Concluded on page 57)

INTERNATIONAL Amateur Radio

Australian Reception Verified!

The reported reception in last *QST* of Australian 3BD by Mr. Y. Ito, 6ACW, of Moneta, Calif., has been verified. The receiver used was a one-tube set with a dry-cell tube and a single tuned circuit connected to an antenna 25 feet high and 55 feet long. The reception checks with 3BD's log for Thursday, November 8th, 7:45 p.m. Australian time. 3BD is the station of Mr. E. H. Cox at 5 Gibson Street, Elsternwick, Australia. This marks the first authentic reception of Australian amateur signals in North America.

Several amateurs have lately reported hearing New Zealand 4AA. The first report was from 9AVG at Eureka, Kansas. When written about it, Mr. Bell, 4AA, replied, "I only wish I had the nerve to fake my log so as to make it check. Hi! As it is I must regretfully plead 'not guilty' ". Sorry, O.M.

The terrific QRM in America on amateur waves is largely responsible for the difficulty in hearing Australian and New Zealand amateurs, because they work on about the same wavelengths as ours. Interest on waves below the regular amateur band is starting over there, however, and that means we will hear more of their signals before long. We should wait until about five hours after sunset on the Pacific Coast to listen for them, thereby giving their signals a chance to make most of the journey in darkness.

Transatlantic Work Increases

Although no outstanding feats have been accomplished during the past month the number of stations both on this side and in Europe that have worked across the ocean has greatly increased. On March first the score in American and Canadian stations worked by some of the best English stations stood as follows: 2OD, 24; 2KF, 21; 2SH, 14; and 2NM, 12. Most of the stations on this side that were worked were experimental stations using wavelengths near 100 meters or else were Canadian stations working on their 125 meter wavelengths.

British 6LJ with a two-tube set, detector and one audio stage, has logged 297 different American and Canadian amateur stations to date. The best reception was in hearing 6AWT, 6BR, and 6XAD, all in California. The well known calls from other districts on his list are too numerous to mention. The best reception for one night was done on a February night when 46 different North American amateurs were heard the last one being logged at 9:30 A.M., broad daylight in England.

Regarding the handling of traffic, American and Canadian stations should remember that English and French amateurs working on experimental permits are prohibited by their governments from handling private message traffic. Mr. Partridge, British 2KF, writes, "Any message relating to radio experiments or tests we may touch, but just as soon as we begin to get the 'Xmas greeting from Fred to Dora by radio' type of message we have to put the bars up."

In other European countries amateur transmitting stations are cropping up fast. New ones are on the air every week and most of them are able to work all over Europe with ease. Some of the new ones are Danish 7EC, 7QF, and 7ZM, Luxembourg 1JW, Finish 2NB, and XY at Geneva, Switzerland. PCII at Leiden, Holland, continues to work Transatlantic with ease.

Mr. Erkki Heino, 2NB, of Suomi, Finland, advises that amateurs in Finland are allowed considerable latitude. Receiving is permitted without a license fee and the wavelength allotted to amateur C.W. transmission is 300 meters with a power of 20 watts.

The loudest short wave signal to be heard from Europe is that of British 2YT at Poldhu, Ireland, on 94 meters. We understand his plate input is twenty kilowatts.

Considering the great advances made in amateur communication in England during the past two years, several of the British amateurs are looking forward to communication with Australia direct! Looking

back but two years, working a French or a Dutch station was quite a feat. Within a month of discovering how to really use the short wavelengths English amateurs are communicating with others up to 5,000 miles distant. It is prophesied that within two years, if not sooner, Australia will hear English amateurs direct and perhaps carry on two-way communication.

A Visitor From England

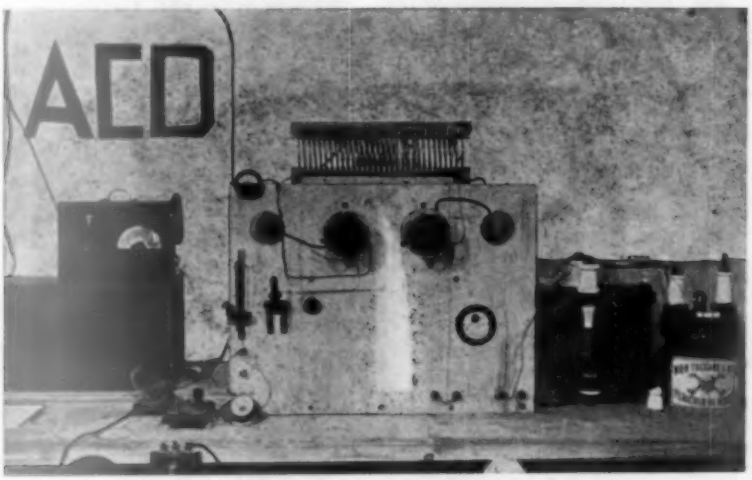
Mr. Gerald Marcuse, British 2NM, who has worked many American and Canadian stations, is going to make a tour of Canada and the States soon. He will arrive in New York about May 10th, and after coming to Hartford and shaking hands with all of the HQ bunch is planning to go across Canada to Vancouver, visiting all of the amateurs he can in all important Canadian cities en route. He would like very much to hear from Canadian amateurs along the way in advance of his trip so as to insure meeting as many of them as possible. Address your letter right away to him in care of the *QST* factory, 1045 Main St., Hartford, Connecticut, to arrive here not later than May 12th.

Here's Your Chance!

The offer made on page 43 of the April *QST* still stands, fellows. No one has worked two-way with Australia or New Zealand *yet*, but some one is going to do it soon. Who will be the first to actually accomplish this feat and go down in the history of amateur radio as one of the pioneers? Don't leave it to the other fellow.

ACD, Italy's Foremost Amateur Station

On the morning of January 21st, after a two minute call, Italian ACD was able to exchange calls with 1XW, thus marking the beginning of Italian-American two-way amateur communication. Four nights later ACD called American stations for five minutes and immediately got in touch with 2AGB at Summit, New Jersey, maintaining communication this time for over two hours. Since then many U. S. stations have had the pleasure of hearing ACD's signals and communicating with him. Mr. Ducati has succeeded in connecting with at least one American or Canadian station most every evening he has tried. On one occasion he reduced his plate input to 45 watts and was still heard very well by 1XAR in Atlantic, Mass.



The first Italian amateur transmitting set to be heard in the United States; built and operated by Mr. Adriano Ducati, ACD, at Bologna, Italy. Since January 21st, when Mr. Ducati succeeded after a two minute call in "raising" 1XW, many stations have heard and worked this Italian amateur station.

Italian ACD is built and operated by Mr. Adriano Ducati, and is located in north central Italy. His complete address is 3 Via Garibaldi, Bologna (29), Italy.

It is not surprising to learn that ACD's transmitter is connected in the manner shown in Fig. 4 on page 27 of the January 1924 *QST*. This is the Hartley circuit with variable series condensers in the antenna and counterpoise leads and is very easy to adjust for good results on wave lengths very near to or at the fundamental. Two French tubes of 50 watts nominal rating each are employed in the transmitter. They are supplied with a little over 100 milliamperes at 2000 volts A.C., making a

plate input of 260 watts. The antenna current on 110 meters, which is the wave on which the transatlantic work was done, is 3.8 amperes. The wave can be lowered to 40 meters if desired and 1.5 amperes put into the antenna.

The transmitter that was successful in crossing the Atlantic is shown in the large

ACD's ANTENNA SYSTEM

photograph. Power transformers are to the right and the two variable series condensers in the radiating circuit are mounted on the front of the panel. By having the wavemeter adjacent to the transmitter as shown, the operator can check the transmitted wave in a few seconds without having to leave his chair.

The small photograph shows mainly the receiving equipment at ACD. On the left is a five-tube universal r.f. receiver (100-20,000 meters) used for broadcast reception only. London broadcasting is heard 300 feet from the loudspeaker on this set, the distance being about 700 miles. To the right of this set is a transmitter using two French 50-watt tubes that is heard over Europe regularly but which has not reached the U.S.A. as yet. It employs the reversed-feedback circuit and the two spiral coils for it are mounted on the wall. Next to this set is the short wave receiver that brings in the American amateurs. It has removable coils and works very well on wavelengths from 10 to 250 meters, using a detector and one audio amplifier. A five-tube set sits to the right of this and receives all waves between 80 and 800 meters. *The wavemeter seen on top of the latter set was calibrated on two points from WWV's transmission.* All receiving and transmitting sets are home-built. KDKA's

A General View Of Station ACD. The successful transatalantic transmitter is at the extreme right.

100 meter wave is received very well on a loud speaker using three tubes.

The radiating system at ACD is unusual and very different from anything we employ in this country. Mr. Ducati uses two counterpoises, one below and one above the antenna. Or you can call it one counterpoise with an antenna above and below it if you wish; the result is the same. The dimensions of Mr. Ducati's radiating system are given in the diagram. The effective height and total resistance of such an arrangement are both quite low, though no tests or measurements have been made to determine just how it compares with the customary antenna-counterpoise arrangement. Some directional effects have been

Adriano C. Ducati, ACD.

noted, however. Here's a splendid chance for some of our experimenters to come to the front!

Foreign Radio Magazines

Foreign amateur radio is advancing so rapidly that it is very much to the interest of the American ham to subscribe to one or more foreign radio publications. Most of us will have to choose a magazine from the English-speaking countries, such as Australia, New Zealand or England, but those of foreign ancestry will derive a great deal of pleasure out of reading the radio doings in the "ould countrie." Incidentally, high school students will find the reading of a French, German or Spanish radio magazine about the only way to cause radio to aid, rather than hinder, these studies.

Below is given a list of several of the more important foreign magazines. The word in parenthesis after the name indicates the language in which it is printed. In each case the price of the magazine in the U. S. is given, unless otherwise noted. Canadian amateurs may find the prices on English magazines to be cheaper to them, so should write the publishers of the respective magazines for more information. Money can be sent by international money order, obtainable at your local post office.

England

"The Wireless World and Radio Review" (English). The official organ of the Radio

Society of Great Britain. A good magazine for the radio man who wishes to keep in touch with radio in England. Published weekly at 12-13 Henrietta St., Strand, London, W.C.2, England. Single copies 5 pence. Yearly 20 shillings.

"Experimental Wireless" (English). A journal of radio research and progress. A good magazine for the serious radio experimenter. Published monthly by Percival Marshall & Co., Ltd., 66 Farringdon St., London E.C.4. England. Single copies 1 shilling 3 pence. Yearly 15 shillings.

New Zealand

"The New Zealand Wireless and Broadcasting News" (English). A live publication containing up to the minute amateur news. Published by L. T. Watkins, Ltd., 15 Taranaki St., Wellington. Single copies 1 shilling. Yearly 12 shillings 6 pence in New Zealand.

Australia

"The Wireless Weekly (English). Official organ of the Australasian Radio Relay League. A live little magazine written in popular style. Published weekly by W. J. Maclardy, Publicity Press, Ltd., 33-37 Regent St., Sydney, N.S.W. Single copies 3 pence in Australia.

"The Wireless Weekly" (English). Offi- (English). A popular magazine for the radio enthusiast. Published monthly by W. Pierpont Black & Co. Ltd., 304 Kent St., Sydney, N.S.W. Single copies 1 shilling 6 pence. Yearly 15 shillings in Australasia.

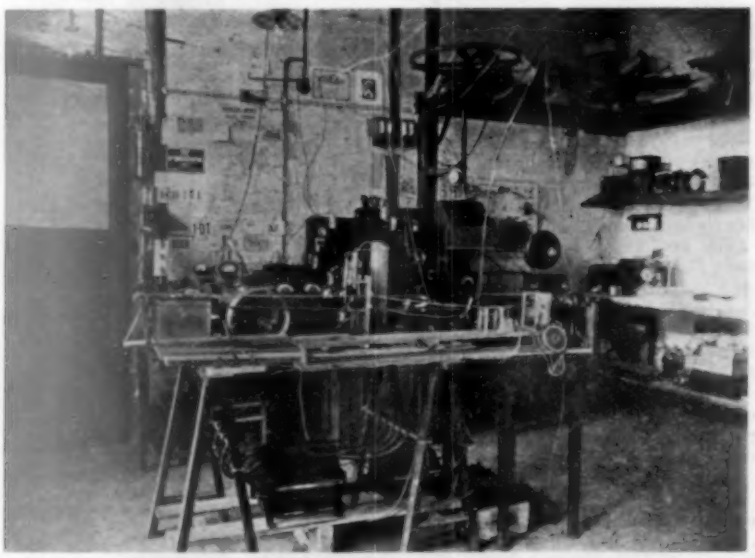
"Radio" (English). A popular wireless review. Published twice a month by The Wireless Press, 97 Clarence St., Sydney, N.S.W. Single copies 6 pence. Yearly 12 shillings 6 pence.

France

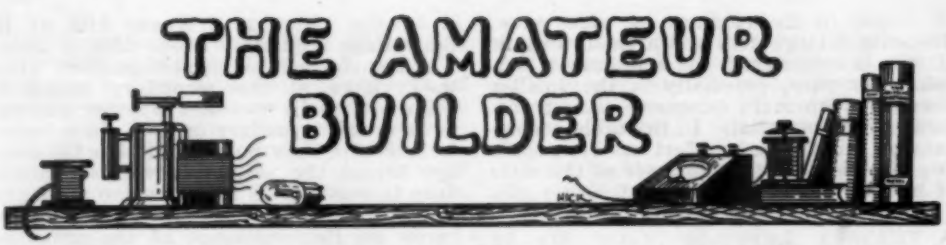
"La T.S.F. Moderne" (French). Official organ of the French Society for the Study of Radio, and other French Society for the Study of Radio, and other French, Belgian and Luxembourg radio clubs. A semi-technical review, probably closest in nature to "QST" of all the French magazines. Published monthly at 11 Avenue de saxe, Paris 7, France. Single copies 3 francs. Yearly 30 francs.

"L'Onde Electrique" (French). Pub-

(Continued on page 57)



A GLIMPSE OF FRENCH 8BF, SECOND FRENCHMAN TO WORK AMERICA. Many readers have heard this station and will be glad to send it cards: the owner is J. Pierre Louis, 8 Rue de la Mouillere, Orleans, France, member A.R.R.L., 8BF first worked 1MO with an input of 110 watts into two 50-watters, D.C. supply, producing 0.8 amp. in the antenna. The station also has a 1 k.w. set using a Marconi MT-4 tube supplied with 25-cycle current at 8000 volts, secured from a converter, putting 3.8 amp. in the aerial at 195 meters, 1.8 at 108 meters. (Antenna ammeter considerably removed from voltage node.) Antenna: 6-wire L cage 55' long, 48' and 60' high, 9-wire fan counterpoise, also earth connection; fundamental of system, 175 meters. The short-wave oscillator uses an untuned-aerial-circuit arrangement evolved by Deloy, 8AB. The apparatus on the table in the photo is an electrically-driven automatic sender used during the last T/A tests, made from Meccano parts and a perforated piece of movie film. 8BF's 1 k.w. sender can get down to 40 meters.



SMALL TRANSFORMERS FOR THE AMATEUR—I.

Simple Fundamentals and Design

By H. F. Mason, Department Editor

THERE is a need for some good reliable data in tabular form giving dimensions and winding details for transformers covering the wide variety of requirements to be met in amateur stations. These will be given in this article. Some practical information on winding the coils and constructing the transformer will be given in this department next month.

Let us first review a few of the more important elementary facts about transformers. A transformer is an electrical device for changing electrical power at a high voltage and a small current to power at a small voltage and large current *(step-down transformer)* or vice versa *(step-up transformer)*. A small amount of power is lost in making the change so a little less power comes out of the device than was put into it. A transformer is *efficient* when the lost power is small. If the loss in watts is 5 percent of the input, for instance, we can say that the transformer efficiency is 95 percent.

A transformer generally consists of several coils or windings of insulated wire placed on an iron core. The *primary winding* is the input winding that is connected to the source of supply while the *secondary winding* is the output winding connected to the load, which may be a tube transmitter or other electrical apparatus.

Most transformers that amateurs make are for use on 110-V. 60-cycle supply. If the frequency and supply voltage are known, the number of turns to put on the primary winding will depend solely on the area of a cross section through one leg of the core, and the number of magnetic lines of force we wish to have per square inch of this cross section. The number of magnetic lines of force per square inch of cross section is called the *flux density*. The flux density that may be used is determined by the quality of the iron employed and the frequency. A flux density of 50,000 lines per square inch for the average transformer iron or silicon steel operating at 60 cycles is used as a basis for the tabular data in this article.

The size of wire which must be used in the primary winding depends mainly on the primary current. It is convenient and customary to use a unit called the *circular mil* in figuring the size of wire to carry a given current. A circular mil is a unit of area. It is the area of a wire one thousandth of an inch in diameter. Such a wire would be so small that 1,000 of them would be needed to carry one ampere of current. This is just another way of saying that 1,000 circular mils are necessary to carry one ampere. This is the proper density to use in the windings of C.W. transformers built for intermittent use over short periods where moderate heating is not objectionable. If the transformer is for a battery charger where it must be left in circuit for a long time, 1500 circular mils per ampere should be allowed, which means that a larger wire should be used.

The number of turns in the secondary winding is governed by the number of turns in the primary and the desired secondary voltage. Before the number of turns for the secondary can be ascertained it will be necessary to find how many *turns per volt* there are in the primary. This can be found by dividing the primary turns by the primary voltage. The number of turns for the secondary can now be found by multiplying this turns-per-volt figure by the desired secondary voltage. The size of wire in the secondary is dependent on the secondary current, and the proper size to use can be found in the same way as for the primary wire.

A fraction of the power put into the transformer does not get through to the secondary circuit because it is used in heating the windings and the core. It is not possible to build transformers that are 100 percent efficient; consequently every transformer is bound to heat somewhat. A transformer can be built with a great deal of iron in its core and a small amount

of copper in its windings, or vice versa. One with a large core and a small amount of wire is better from the amateur's standpoint, for wire, especially in the smaller sizes, is much more expensive than transformer core material. In the table accompanying this article an effort has been made to proportion the transformers so the ratio of iron to copper will be good.

When a transformer is switched in and

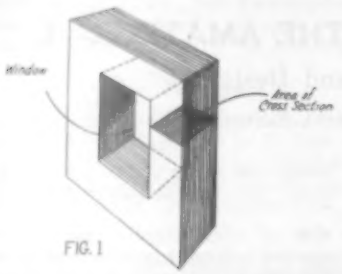


FIG. 1

a constant load applied to the secondary, the core and windings will gradually warm up to a certain value above the room temperature and stay there regardless of how long the transformer is left on. The transformer should be designed so that this steady temperature is well below that which will damage the insulation. Because transformers that run warm can be built much cheaper and smaller than ones that run comparatively cool, a certain amount of heating is not objectionable. This does not mean, however, that the design should be skimpy.

When no current flows in the secondary circuit of a transformer only enough current flows in the primary to supply power to make up for the small losses that occur in the core and primary winding. If the input to a small transformer is over one ampere in the primary circuit when nothing is connected to the secondary you can be sure that there is something wrong with the design; the core is poorly put together, or there is a leak somewhere. The transformer is not a wasteful device; it takes from the line only as much as you use out of the secondary, with just enough extra to make up for its losses and no more. Good transformers will stand 50 percent overload for short periods without harm, but these short periods should not be made continuous.

The secondary voltage of a transformer will be pulled down somewhat when the full load current flows in the secondary winding. The drop in secondary voltage between no load and rated load, expressed as a percentage of the no-load secondary voltage, is called the *voltage regulation* of the transformer. For instance, if the secondary voltage of a transformer is 15 with no load, and it drops to 12 when the rated load is applied to the secondary, the drop is 3 volts. Because 3 is one fifth of 15 the voltage regulation is one fifth or 20%.

A transformer has good regulation when the voltage at the secondary terminals holds practically constant whether current flows in the secondary or not. In a transformer with very poor regulation the voltage across the secondary will sometimes drop to one-half its former value when the load is applied. The voltage regulation depends on the resistance of the windings and the magnetic leakage between the windings. Good regulation can be had by compactly arranging the transformer so the turns of wire lie close to the core and the primary and secondary windings are adjacent, which reduces the magnetic leakage. The total length of the magnetic circuit (meaning the path around the core that the lines of force travel) should be short and the joints in the core must be good. The resistance of both windings should be low. Some arrangements of the core and windings of core-type transformers for good and poor regulations are shown in Fig. 2. The arrangement in Fig. 2-H is a useless refinement for small C.W. transformers, though it is used in large power transformers. Figure 2-E is good enough for most purposes, is easier to make, and will give less insulation troubles.

Transformers for spark sets are purposely designed to have poor regulation so that when the secondary is short-circuited by the spark gap the secondary voltage will drop and prevent a large secondary current from flowing. This in turn prevents an excessive demand of power from the line. C.W. transformers should have good regulation so that the secondary voltage will not change much when the key is pressed.

A Practical Example

In the accompanying tables data are given to assist the amateur in planning the construction of a transformer for his particular needs. Let us take a typical case and find the dimensions and winding details of a transformer to supply plate voltage for one 50-watt tube, type UV-203.

The first step is to decide what the secondary voltage and current shall be. The general amateur practice is to supply one of these tubes with about 170 milliamperes of plate current at about 1200 volts. Allowing 300 volts drop in the rectifier and filter, which is not unusual, 1500 volts will be required at the secondary terminals. To take care of greater plate current than we anticipate it would be well to make the transformer capable of delivering 240 milliamperes (0.24 amperes) without overloading. The watts output then will be 1500 x 0.24=360. A home-made transformer of this size will be about 90 percent efficient which means that 360 watts is 90 percent of the input. Dividing 360 by 9

and multiplying the quotient by 10 will give 400 watts as the input.

Table 1 gives data on transformers of various powers for use on a 110-V. 60-cycle line. This table gives the cross-section dimensions of the core and the number of turns and size of wire for the primary for several different transformers. The

TABLE 1—TRANSFORMERS FOR USE ON 110-V. 60-CYCLE CIRCUIT

Input (Watts)	Approx. Efficiency	Size of Primary Wire	No. of Primary Turns	Turns Per Volt	Cross-Section Through Core
50	75%	23	528	4.80	1¼"x1¼"
75	85%	21	437	3.95	1⅜"x1⅜"
100	90%	20	367	3.33	1½"x1½"
150	90%	18	313	2.84	1⅝"x1⅝"
200	90%	17	270	2.45	1¾"x1¾"
250	90%	16	248	2.25	1⅞"x1⅞"
300	90%	15	248	2.25	1⅞"x1⅞"
400	90%	14	206	1.87	2 "x2 "
500	95%	13	183	1.66	2⅛"x2⅛"
750	95%	11	146	1.33	2⅜"x2⅜"
1000	95%	10	132	1.20	2½"x2½"
1500	95%	9	109	.99	2¾"x2¾"

figure in the second column "approximate efficiency" was used in the paragraph above to find how much greater the input would be than the output. The third and fourth columns tell us that for the 400-watt transformer we are figuring on, the primary winding should consist of 206 turns of No. 14 wire. The sixth column tells us that the core should be 2 inches by 2 inches in cross section.

The next step is to find how many secondary turns will be required for 1500 volts, which was the figure decided on at the start. In the fifth column of Table 1, on the 400-watt line, is given the number of *turns per volt* in the primary winding. This figure multiplied by 1500 will give the number of secondary turns; i. e., 1.87 x 1500 = 2805. Five percent of 2805 should be added to it to make up for the voltage drop that is bound to occur when the full load is applied to the secondary because of the transformer losses and regulation. This will give a final result of 2945 secondary turns for the 1500 volt winding under full load.

In supplying plate current through a rectifier it is usual to rectify both halves of the cycle by using a separate secondary winding for each half cycle. This will require two 1500 volt windings or one 3,000 volt winding with a center tap. Theoretically it would be possible to use a smaller wire in the secondary winding because each 1500-volt section is passing current half of the time. In practice, however, it is far better to stick to the figure of 1,000 circular mils per ampere and be on the safe side.

The current-carrying capacity of copper wire is given in the seventh column of Table 2. We are looking for a size of wire for the secondary that will safely carry 0.24 ampere. The nearest we can come to it is to use No. 27 wire. Two windings of 2945 turns each will be needed; making a winding of 5890 turns with a center tap.

Now that we have the wire sizes and the number of turns and size of wire for both primary and secondary, and know that the cross-section of the core should measure 2 by 2 inches, all that remains

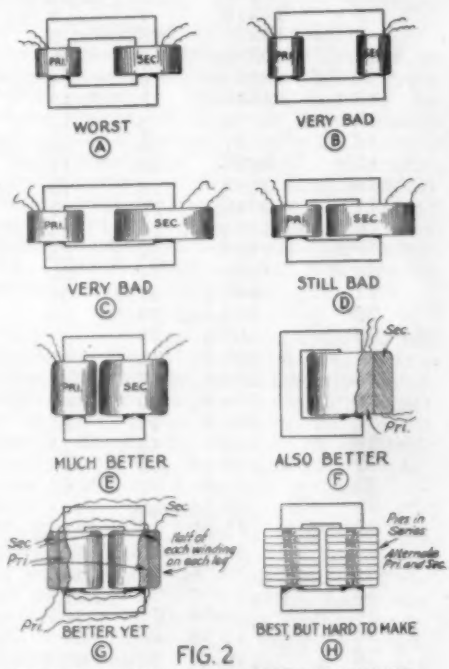


FIG. 2

HOW THE ARRANGEMENT OF THE CORE AND WINDINGS AFFECTS THE VOLTAGE REGULATION OF CORE TYPE TRANSFORMERS

is to build a core with this cross-section that will have an opening or *window* in it just large enough to get the windings

on. See Fig. 1.

The best way of finding what the size decide on a tentative length of winding.

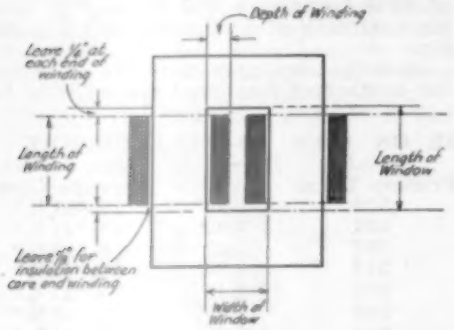


FIG. 3

make a full size drawing of the transformer on a sheet of paper. When finished it will look somewhat like Fig. 3. First Leave a full quarter of an inch between the end of the winding itself and the adjacent leg of the core as shown in Fig. 3. Then find how many layers will be needed to get the required number of turns. The depth of winding can next be ascertained, leaving at least ⅛ inch for insulation between the core and the inside layer of wire. Allow for insulation between layers, if there is to be any. Having finished these computations you can draw the primary winding in, full size, on your drawing and see just how it is going to look.

The next step is to figure the depth of the secondary winding in the same fashion, using the same length of winding as was used in the primary. If enamelled wire is to be used in the secondary, be sure to allow enough room for a layer of heavy paper between each layer of wire. When the depth of primary and secondary windings has been found, their sum, plus about ¼ inch for good luck, will give the total width of the window in the core. If the drawing of your transformer now begins to

TABLE 2—COPPER WIRE

Size of Wire B.&S. Gauge	Area in Circular Mils	Turns Per Inch		Feet Per Pound		Carrying Capacity at 1000	Carrying Capacity at 1500
		D.C.C.	Enamel	D.C.C.	Enamel	C.M. per Amp.	C.M. per Amp.
8	16510.	7	8	19.6	19.9	16.5	11.0
9	13090.	8	9	24.6	25.1	13.1	8.7
10	10380.	9	10	30.9	31.6	10.4	6.9
11	8234.	10	11	38.8	39.8	8.2	5.5
12	6530.	11	12	48.9	50.2	6.5	4.4
13	5178.	12	13	61.5	63.2	5.2	3.5
14	4107.	13	15	77.3	79.6	4.1	2.7
15	3257.	15	17	97.3	100.	3.3	2.2
16	2583.	16	19	122.	125.	2.6	1.7
17	2048.	18	21	151.	160.	2.0	1.3
18	1624.	20	24	192.	202.	1.6	1.1
19	1288.	22	26	240.	254.	1.3	.86
20	1022.	24	30	298.	319.	1.0	.68
21	801.1	27	34	373.	402.	.81	.54
22	642.4	29	38	464.	506.	.64	.43
23	509.5	31	42	575.	638.	.51	.34
24	404.0	34	47	711.	804.	.41	.27
25	320.4	37	53	878.	1010.	.32	.21
26	254.1	40	60	1080.	1280.	.25	.17
27	201.5	44	67	1330.	1610.	.20	.13
28	159.8	48	75	1630.	2030.	.16	.11
29	126.7	52	83	1990.	2560.	.13	.084
30	100.5	55	93	2420.	3220.	.10	.067
31	79.70	59	106	2820.	4050.	.079	.053
32	63.21	62	119	3500.	5100.	.063	.042
33	50.13	66	133	4160.	6420.	.050	.033
34	39.75	70	147	4920.	8080.	.039	.026
35	31.52	73	167	5760.	10200.	.032	.021
36	25.00	77	185	6660.	12800.	.025	.017
37	19.83	80	208	7600.	16100.	.020	.013
38	15.72	83	233	8450.	20300.	.016	.010

decide on a tentative length of winding. From column 3 of Table 2 (No. 14 double cotton covered wire will be used in the primary) see how many turns per layer can be obtained in the primary winding. look like Fig. 2D instead of 2E, then use a different value for the length of winding and begin figuring the size of window all over again. Be certain that the window is large enough to get the windings on, but

do not make it any larger than necessary or the regulation of the transformer may be impaired.

The design of the transformer is now complete. How to build up the core, wind the coils, and mount the transformer will be told in the second part of this article in the June *QST*.

WHO'S WHO

L. W. Hatry

(Concluded from page 48)

stores, sold the bicycle, and joined the A.R.R.L. In 1919 he bought one of the old familiar Audiotrons with the double filament and the easily broken connections. Upon hearing old 8ZG he became determined to build a transmitter for himself. After a lot of spark-coil work which was work and usually did not work, he tried his hand at an Amrad quenched gap and a half-kilowatt transformer.

When Mr. Hatry became interested in C.W. transmission, "try it and see" was his motto. He is therefore a born experimenter. His experiments with a 5-watt tube transmitter as chronicled in his articles "How to Make a Five-Watt Tube Reach Out" and "Some C.W. Experiments and Results" in past issues of *QST* contain a wealth of information on this subject that has been invaluable to many amateurs. As a result of these experiments he now has a transmitter that is regularly heard throughout the greater part of the country. His station, transmitting on a 75 meter wave, is one of the best of the chain of A.R.R.L. Broadcasting Stations. Mr. Hatry holds a first grade commercial license and has operated commercial and broadcast land stations.

Regarding his viewpoint on amateur radio, "I hope I will always stay in this delightful trance," he was heard to remark at the Second National A.R.R.L. Convention. Attending that convention was the biggest event in his life, he says.

WHO'S WHO

Maurice G. Goldberg

(Concluded from page 48)

always keep about one jump ahead of the rest of us in the improvement of amateur radio and thereby lead the way towards better apparatus, better efficiency, and better DX.

On the air he is known as 9APW-9ZG. The station is located at his home at 711 Dayton Street, St. Paul, Minnesota, and has been heard throughout the country. Mr. Goldberg first broke into the radio game in 1917 wondering why the door bell would not work right when the push button, batteries, and bell were all connected in shunt. He received his first license in 1919 and started up with a one-kilowatt spark that reached far enough to burn up several fixtures and weld various pull-chain sockets in the neighborhood. C.W. was installed the following year. Since then 9APW-9ZG has been heard in ten countries and on three seas, despite an unfavorable location for the transmitter. The carrying power of the signals has been due in great part, no doubt, to the use of pure direct current on the plates of the tubes.

Mr. Goldberg has always taken a prominent part in radio club and A.R.R.L. activities in and around the Twin Cities. He is a past president of the Y.M.C.A. Radio Club of St. Paul and is now Vice President of the Twin City Radio Club and a member of the Twin City Executive Radio Council. He ably handles the office of District Supt. of Minnesota Dist. No. 3, while his station is an Official Relay Station and an Official Broadcasting Station. Mr. Goldberg is a graduate of the University of Minnesota Electrical Engineering College. He is a Second Lieut. in the Officers' Signal Reserve Corps and has spent two summers at Camp Alfred Vail, New Jersey, absorbing the latest dope on army radio.

INTERNATIONAL AMATEUR RADIO

(Continued from page 52)

cation of the Society of Radio Friends. A technical journal similar to the I.R.E. Proc. in this country. Published monthly by Étienne Chiron, 40 Rue de Seine, Paris. Single copies 3 francs. Yearly 35 francs.

"Radio Electricite" (French). A practical radio review written in semi-technical style. A technical bulletin is included as a supplement from time to time. Published twice a month at 98 bis, Boulevard Haussmann, Paris 8. Single copies 2 francs 50 centimes. Yearly 45 francs.

Spain

"Teleradio" (Spanish). Official organ of the Radio Club of Spain. A semi-technical magazine for the radio fan with many articles written in popular style. Published monthly by F. Perez Martinez, Palacio del Banco o de Bilbao, Alcald 16, Madrid, Spain. Single copies in Spain 1 peseta; or one year for 10 pesetas in Spain.

Netherlands

"Radio-Nieuws" (Dutch). Organ of the Netherlands Radio Society. A semi-technical journal, the "QST" of Holland. Published monthly by N. Veenstra, Laan van Meerdervoort 30, Den Haag, Netherslands. Single copies 25 francs. Yearly 10 francs.

'Radio Wereld" (Dutch). A weekly sheet for the radio enthusiast written in semi-technical style. A real live publication. Published monthly by Engers and Faber, N. Z. Voorburgwal 250, Amsterdam, Netherlands. Single copies 25 francs. Yearly 10 francs.

(Continued on page 63)

8ATR, of Rochester, New York, is all fixed for Railroad Emergency work. He has installed an auxiliary five-watt set operating on an indoor antenna from storage batteries and a dynamotor, thus permitting his station to remain in commission even when outside power is cut off and the regular antenna down. FB, OM, vy.

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One of the loyal members of the R.O.S. has just sent us a list of the officers of their worthy organization. Grand Exalted Sucker, Howard T. Cervantes, 2ACT; Vice Grand Exalted Sucker, Harold M. Marquis, 9AGV; Secretary, E. J. Possett, 9BWP; Treasurer, D. Tally, 2PF; Grand Czar, Leo Topolinski; Surgeon of Arms, T. E. Nikirk, 6KA; Chief Grave Digger, T. F. Pheiler, 9EHS; Guardian of QRN, C. W. Lynden, c3MM; Chief Wind Jammer, R. H. G. Matthews, 9ZN. The above will bring pleasant memories to those who attended the Chicago Convention last summer.

P.S.: Are there any more railroad certificates?

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Regarding President Coolidge's holiday greetings message to WNP, the routing of which was given on page 27 of the March 1924 *QST*, the following has been received from 9ZT: "I received the message from 9AIM on December 25th at 6:15 A.M. All through the next morning I battled with it until finally after the room was full of smoke from my filament rheostat, which gave up that morning, Canadian 5GO, OK'd for it at 4:21 A.M. Was this the way it got to 5GO?" Really, this message was handled by so many stations that a complete story will probably never be known, but the above correction will help clarify the history of the message as given in the March issue.

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At this stage of the game wouldn't it be nice if someone would invent some kind of a lingo-former; a transformer gilhicky into which the signals of foreign stations could be fed, delivering English at the secondary terminals, or vice versa when used in the transmitting set? By suitable plug-in arrangements on your set you could easily plug in the proper lingo-former for the language of the country you are working at the time. This is just an idea for inventors to work on. Such a device would do away with the necessity for an international auxiliary language also.

Speaking of lingo-formers, "LQ" has a little loud speaker that has only been over from Germany for two weeks, yet it can talk perfect English. What do you think of that?

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The highly insulated filament transformer that must be used in conjunction with kenotron rectifiers can be obtained by connecting an old 110-2200 volt pole transformer up backwards, feeding 110 volts to the 2200 volt winding and connecting the filament to the 110-volt winding. It will then deliver about 11 volts to the filaments, through the rheostats as usual. This gives a filament transformer insulated for 2200 volts.

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9CTC finds it possible to use a rectifier bulb that is burned out by connecting it to the battery in the usual way and then applying 300 volts from his C.W. power transformer to the filament momentarily. The filament was of course burned out beforehand. After the initial flash at the broken filament the tube will start to rectify and the filament will remain heated of its own accord.

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Doesn't anyone know the identity of JUPU? This C.W. station, that was worked by 7HG on amateur waves, has now been reported heard in Ohio. QRA?, OM pse.

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It will be an excellent idea for A.R.R.L. representatives in each city to have the League's name put in the telephone directory and city directory, likewise to notify the Chamber of Commerce and the Postmaster of the League's existence and local representation. This would not only help visiting amateurs and others to get in touch with the local A.R.R.L. men, but would facilitate the delivery of mail as well.

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By the use of loops as direction finders an unlicensed amateur station in Oakland,

Calif., operating under the ficticious call "6LL", was located by the Supervisor of Radio recently. We hope this will serve as a warning to others who think they can "get by" without a license, even if for only a few days. Neither the Department of Commerce or the A.R.R.L. have any patience with an outlaw station.

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The two-ampere battery charging outfit described on page 46 of last month's *QST* can be used for charging storage B batteries by connecting it as shown in the accompanying cut. The charging rate, which should never exceed a quarter of an ampere, is determined by the size of lamp connected in series with the battery and the voltage of the battery being charged. For charging a 45-volt battery a 75-watt

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The General Radio Company of Cambridge, Mass., have purchased a tract of land adjacent to their present factory and will start construction at once on a four-story concrete building. This new unit will have the same capacity as their present building, thus doubling their production facilities.

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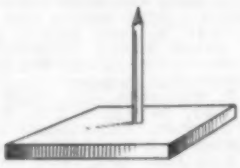
3PH could not find the nodal point in his antenna system after much hard work and experimentation so Wadsworth, of 3JJ



NODAL POINT, 3PH

fame, made one and presented it to him. It looks something like this and he is highly pleased with it.

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Notice to all Hams: All amateurs in favor of having an Indiana Convention of the A.R.R.L. in the near future please write to A. H. Barnett, 9AKO, 33 Kiwanis Apt., Fort Wayne, Indiana. Come on, gang, lets go!

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The Board has adopted black and gold as the official A.R.R.L. colors.

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Miss Margaret M. ("Peg") King, *QST* bookkeeper and cashier (reviewed on page 53, *QST* January—Copies available from the Circulation Dept.)—hi!) is now Assistant Treasurer of the A.R.R.L., by recent action of the Board.

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STATION KINKS

For those who are nutty on plate glass insulators: To drill the holes in the ends, take a ¼ inch diameter rat tail file and carefully make a chisel end on it with an emery wheel. Use a regular brace; a speed drill is n.g. A board with a hole in it is fine for keeping the drill in one spot till the hole gets started. Keep the drill lubricated with 3-in-1 oil or turpentine. It should take only about two or three minutes to drill a hole through a ¼ inch plate of glass if the drill is good and sharp.

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Amateurs Know Nothing About Dead Spots

We have just made an unpleasant discovery—that the amateur does not know anything about the dead spots in the ether. This is indeed quite a jolt as we thought our members would know the location of hundreds of dead spots. Yet it seems that from the results of various requests for this information that 9AMZ is about the only man in the League who knows anything about the matter—or who can locate a single dead spot. What's the matter with the rest of you?

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Nodal Point on Inductively Coupled Sets

Many of our members have just awakened to the fact that the adjustment of the nodal point in a transmitting set is too essential to overlook any longer. If their tubes run hot and their sets do not "get out" the trouble in most cases can be remedied by properly locating the voltage node as explained on page 11 of the September, 1923, *QST*. What to do about adjusting the position of the elusive node in an inductively coupled set makes them scratch their heads, however. The answer is that in an inductively coupled set it will probably not make much difference where the voltage node is as long as it is somewhere in the antenna inductance coil. If a single series condenser is used and a counterpoise, put the condenser on the antenna side of the coil. It is on a conductively coupled set that the location of the nodal point really counts.

— - - - —

Re Low-Loss Tuners

There seems to be some misunderstanding regarding the antenna coil on a tuner such as was described in the article "Low-Loss Tuners" in the February, 1924, *QST* and how it affects the operation of the set. An important advantage of the tuner described is that when properly built the antenna coil position need not be changed with different positions of the secondary tuning condenser, if the natural wave length of the antenna coil is outside of the working range of the tuner and if it is coupled rather loosely to the secondary coil. Of course the proper inductance or shortening-capacity to put in the antenna circuit, so the natural wave length of this circuit will

(Continued on page 62)

Some Traffic Facts

By F. H. Schnell, Traffic Manager

AFTER listening to all sorts of arguments about what happens to our messages and how none of them ever reach their destination, but without deriving any real constructive suggestions on what to do about it, I took a bunch of correspondence (we get it in bunches at Headquarters) and answered it by radiograms. I was sure all of these replies would get through, because as soon as a message left 1XW, a duplicate copy was mailed direct to the addressee. When a message was on its way, a tracer message (sort of questionnaire) was mailed to the first station to which the message was sent from 1XW. As soon as the first tracer came back with the required information, another tracer was mailed to the next station handling the message, and so on right through to the addressee. This gave a double check on delivery and one of them had to work.

Nearly every message in this record was delivered. Some were delayed entirely too long, which is inexcusable, and others were garbled, for which no excuse can be manufactured. The business of garbling a message is a sure sign of weakness on the part of somebody. Either the transmitting operator has a bum fist (in which case the receiving operator should not QSL for a message until he is sure it is perfect copy) or the receiving operator hates to admit that he cannot copy everything, no matter how rotten or at what speed it is sent. When contact is established between stations there is no excuse for garbled copy. If the receiving operator is not sure of himself, he should not be ashamed to ask for repeats. It is not a crime to ask for repeats—it is far worse to let yourself think you have perfect copy when you are in doubt.

About delivery, the only thing we can say is this: *When a message has been on your hook for 48 hours, don't hold it any longer — MAIL IT.* A card will do it. Some of the delays which appear in the "Facts" are worse than third-class mail.

Here is what has taken place with some of these messages:

All messages were started from 1XW-1MO. The numbers appearing are for reference only and must not be confused with the actual number of each message as it was transmitted to the various stations. In each case complete address was given, the date was transmitted, and no abbreviations were used, but to save space we will have to shorten them a bit in the reporting.

Message Nr. 1, addressed to Mr. Tuttle, San Francisco, Calif. 1XW to 6BCL 2/20 10:55 P.M., EST. 6BCL mailed it and it reached the addressee in the first mail of 2/21.

Nr. 2—Washington Herald, Washington, D.C. 1XW to 3EH 2/20 7:50 P.M. to 3PZ 2/21 7:30 P.M. After two unsuccessful attempts to deliver by phone on 2/21 and 2/22, 3PZ finally delivered it in person 2/23. It was addressed to an individual but we don't understand why 3PZ didn't leave it with somebody at the office.

Nr. 3—A. B. Goodall, 3AB. 1XW to 3CKJ 2/21 6:32 P.M. No further record—3CKJ reports his log destroyed and Goodall has not advised that the message was received by him. What happened to it?

Nr. 4—B. J. Kroger, 3APV. 1XW to 3CKJ 2/21 6:35 P.M. No further record—same status as Nr. 3.

Nr. 5—F. T. Wilcox, 9AAL. Looks like it might have gone thru a concrete mixer. 1XW to 3PZ 2/21 11:51 P.M. EST, to 8VE 2/26 11:51 P.M., EST, to 9BBI 3/1 12:07 A.M., EST, to 9CNO in person 3/4, and thence by mail to 9AAL on 3/5. In the first place the text of this message was as follows: "I have received your acknowledgement to my letter regarding the interference in St. Louis and await further reports from the secretary of the Radio Transmitters Association which I hope will be forthcoming within the next week or ten days", but here is a copy of the text as 8VE reported back after taking the message from 3PZ: "Have received ur ans to my letter regarding the interference in St. Louis and await further within the next week or ten days." 3PZ or 8VE or both are to blame for garbling this, as no other station handled the message up to this point, and if 3PZ had trouble in copying from 1XW he should not have QSL'd the message. Five days delay at 3PZ is inexcusable—why wasn't the message mailed after holding it 48 hours? 8VE held it over 3 days and accounts for the delay as being very QRW school work. Why wasn't it mailed? 9BBI blew a tube while trying to give it to 9AAL, but then he held it until March 4 before he carried it over to 9CNO who finally mailed it. Part of it got to Wilcox all right—but who butchered that message?

Nr. 6—F. B. Westervelt, 8ZD. 1XW to 3PZ 2/21 11:45 P.M., EST, to 8XBH 2/25 7:36 P.M., to 8FM 2/26 6:15 P.M., EST, thence mailed special delivery to addressee 2/27. 3PZ also gave it direct to 8VE 2/26 5:24 P.M., EST. Five days from Hartford to Pittsburgh by radio! 3PZ can have the leather medal for this one. 48 hours or mail!

Nr. 7—Supervisor of Radio, Boston. 1XW to 1CMX 2/21 7:40 P.M., to 1XJ 2/22 1:45 A.M., mailed and arrived at destination 2/25. Uncle Sam must have delayed this one as it was mailed at noon of 2/22.

Nr. 8—W. Moore, 9DES. 1XW to 9EFH 2/21 6:59 P.M. EST, to 9AJE 2/22 12:15 P.M., CST, and mailed to addressee 2/28, but we doubt if it ever reached 9DES because the address became scrambled and it went to Kansas City instead of Caney. Who garbled it?

Nr. 9—W. T. Gravely, 3BZ. 1XW to 3CKJ 2/21 6:29 P.M., EST. 3CKJ reports his log destroyed and record is not complete. The message was received by Gravely 2/28 but the text read like this: "Havent heard ur sigs since my card," although it left 1XW like this: "Unfortunately I have not heard your signals since my card stop please keep going OM and we will connect up soon." Don't know where to fix the blame for the garbling and delay. Better keep a log, 3CKJ, and hold your messages for a month so you can trace them when asked.

Nr. 10—Radio 4BL. 1XW to 3CKJ 2/21 6:41 P.M., EST. 3CKJ log destroyed but the message got to 4KU and was mailed from there, arriving at 4BL 2/28 9:00 A.M. Badly garbled as only 13 words were received by 4BL and 29 were started from 1XW.

Nr. 11—H. L. Reid, 4KU. 1XW to 3CKJ 2/21 6:37 P.M. Log destroyed but message was delivered by 4MB 2/24. Routing unknown.

Nr. 12—Oakland Tribune, Oakland, Calif. 1XW to 6XBC 2/22 3:35 A.M., EST. Delivered by mail and reported back 2/27.

(Concluded on page 63)

Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents

QRB?

926 Michigan Ave.,
Evanston, Illinois.

Editor, *QST:*

Many amateurs have a rather exaggerated notion of the distance to some station which they have worked. In radio, distances should always be measured along the shortest path on the earth's surface, which is along the arc of a great circle; for short distances it is practically a straight line. This is much shorter than the distance by road or railroad.

The most convenient way of measuring distances to DX stations in an area the size of the United States is to get a large, accurate map, and then with your own station as center draw circles with radii of 100, 200, 300, etc., miles, in accordance with the scale of the map. Then, when another station is located on the map, you can immediately see which circles it lies between and estimate the distance to the nearest ten miles; or the distance from the station to the nearest hundred-mile circle may be transferred with dividers to the scale printed on the map.

To find the distance to a foreign station, or to find distances in the U. S. more accurately, the following formula from spherical trignometry is conventient:

$\cos a = \cos b \cos c + \sin b \sin c \cos A$,

where a is the required distance, b and c are the co-latitudes (90° minus the latitude) of the two stations, and A is the difference in longitude. This formula gives the distance in degrees of arc. One minute of arc equals noe nautical mile or 1.152 statute miles. One degree of arc equals 69.08 statute miles.

The latitude and longitude of each station may be taken from a large scale map and used in the above manner to find the distance between them. Figuring to the nearest minute is more accurate than necessary, for a minute of arc on the earth's surface is about a mile, while a second is only about 100 feet.

—E. W. Kimbark, 9AMZ.

Another Record

4909 Fletcher St.,
Chicago, Ill.

Editor, *QST:*

I hereby make all claims to the most "miles per watt", "miles per dollar", etc., etc. The first liar "aint go no" chance.

Received a card from PCTT, of Noordwyk, Holland, stating he heard my A.C. C.W. sigs "fine and steady" on Feb. 27. As I have not had my transmitter in operation since about October, I take it for granted that he heard my receiver oscillating! My receiver consists of a Zenith with detector and two stage a.f. amplifier and phones won at the National Convention. The detector tube used at the time was borrowed from a local B.C.L. (hi!) and the storage battery set me back $18 just two years ago! Think this record beats Aussie 2CM's and any other record you care to bring forth. In awarding any Transatlantic prizes, please ship me those "ventilated vacuum tubes" via airplane mail. Gosh, even if I do say it myself, didn't think I could get to Holland on a UV200.

—Beverly Dudley, 9BR.

Edison Batteries the Berries for Plate Supply

Timmons, Northern Ont.

Editor, *QST:*

I have tested out the Edison B batteries I recently bought through an ad in *QST* and beg to submit my report on same. The set I have here now has been working one month. It uses four 5-watt tubes on C.W. and two of them are modulators when using phone or I.C.W. The set has been used steadily every morning from 2 A.M. to 8 P.M., six solid hours. The average space current has been around 175 milliamperes. Have often used phone steady for 20 minutes and kept up this series of 20 minute phone talks for three hours, stopping only long eough between times for the other guy to come back at me.

After a four or five hour run like the above the Edison battery would begin to fall off and then the boys around about would begin to say "some QSS now." Then I know it's time to call it a day. Of course you can see it on the set too, as the antenna current will start out good when starting to talk and fall away in sympathy with the voltmeter on the Edison batteries, which ship away fast when the load is piled on. That's a good sign she's "down," so I close down the work at daybreak.

On observation I find that she gives a

good 500 volts when she is right up and fully charged. The actual figures given below were taken under working conditions.

Voltage of 400 cells when fully charged	650 volts
When a 175 m.a. load is applied	620 volts
When 175 m.a. is applied for 5 minutes	600 volts
After battery has rested 10 minutes while other guy has his say	630 volts
When I put load on again	600 volts
After running 5 minutes	585 volts
After resting 10 minutes	600 volts
After working two hours	530 volts
After working four hours	490 volts
After working six hours	430 volts

She is "done" now. But Boy, Oh Boy! when she is *right up* to solid full charge, all I have to do is to step on her and the boys start to holler for me. The antenna power is 30% higher when I start out than at the end of a 5 or 6 hour run.

Have been reported in 30 states in 27 days, (and I have to go 400 miles before I hit a state, too). DX on phone is 1,000 miles "perfect in every syllable", they say, and 2400 miles on C.W.

So—I am rigging her up now so I can

CANADIAN 3GG. The Edison Storage batteries that supply the plate circuit, with the charge-discharge switch and plate voltmeter, are seen at the left of the picture.

throw her over for a charge each time I throw the aerial change-over switch. How-zat for keeping her *full o' pep*?

—M. J. Caveny, Can. 3GG.

Long Waves QSA in P.R.

Box 660, San Juan, Porto Rico.
Jan. 12th, 1923.

Editor, *QST*:

In looking over *QST* for January I saw your "Stray" concerning long wave reception. I have always followed with interest all articles concerning long wave reception.

To start I might state that fairly constant signals from the high powered European stations are heard all the year around here in P.R. The antenna employed at this station is in the form of a V consisting of a single strand of copper wire taken from an old power transformer, being about one eighth inch in cross section. Tests have been made to determine the best type of ground connection for receiving purposes and I have found that a good ground is absolutely necessary for good results. At this station the ground consists of a square skeleton wooden framework with about five hundred feet of number fourteen gage wire wound around it and buried at a depth of six feet. In addition another straight stretch of wire is used and connections have also been made to the water pipes.

There is nothing extraordinary about the receiver in use at this station. It is the conventional three-coil honeycomb receiver used in conjunction with a two step amplifier. All tubes used are hard tubes as I have found that a soft tube is NG for long wave reception. I am more or less addicted to the use of but one tube.

I believe one thing that cannot be emphasized too strongly is the fact that it takes time and patience to acquire the knack of handling honeycomb coils correctly.

As to results at this station: LY at Bordeaux has been received strong enough at this station on one tube to copy his press on a mill! LCM, UFT, MUU and POZ are also quite strong on one tube although of course they are much harder to read than LY due to their shorter wavelength. As to the naval stations, they also are copied quite nicely, such stations as NBA, NPM, NPL and NDD being copied regularly. NPL has also been tuned in strong enough to copy him on one tube on a typewriter. LPZ, the new Swedish stations, has been heard, although not regularly .

I hope that this will be of interest to others who are interested in long-wave reception.

—Francis McCown.

STRAYS

(Continued from page 59)

be just outside the operating range, will vary with the antenna used. The wave length to which the antenna circuit is tuned will be indicated by the wave length adjustment on the secondary condenser where abnormally tight tickler coupling is required for oscillation, or else at which the set will not oscillate at all. If there is such a point on your tuner, then put a loading coil or a shortening condenser in series with the antenna to put this point outside of the band of wave lengths covered by the secondary tuning dial.

The "Brooklyn Standard Union" says

that the name of the King of Burmah, Sirirariphavanadityapaurapanditasudhamarajamahadahipatimarapatisithu, can never be broadcast. We are certain, however, that we have heard it being tried.

— - - -

A prominent amateur on the West Coast is having a hard time figuring out whether any H's are lost in the conversation when a Yank works an Englishman. Perhaps some of the stations working across the Atlantic can explain this for the enlightenment of the rest of us. Hw?

— - - -

5QF saw a bird sitting on a limb, and being of a cussed nature, threw a rock at it. The little bird only jumped to higher limb and chirped: "—. —.."

— - - -

If your letter to *QST* has not been answered you probably put your address on the envelope but *not* on the letter—or maybe you signed your call instead of your name. We have a whole file of such "dead letters."—The Editors.

SOME TRAFFIC FACTS

(Concluded from page 60)

Nrs. 13, 14, and 15. Routing not completed; will be reported later.

Nr. 16—Lester Picker, 6ZH. 1XW to 6XBC 2/22 2:56 A.M., EST. No further record. Up to 3/9. 6XBC reports he is unable to raise anybody south of Los Angeles. 48 hours, then mail 'em, OM!

Nr. 17—Len Weeks, 9DKB. 1XW to 9CGB 2/22 6:46 P.M., EST, to 9BRI 2/22 6:30 P.M., CST, thence by mail 3/1. 9BRI explains his delay due to blown tube, but that answer is N.G. Why didn't you mail it after you held it 48 hours?

Nr. 18— D. C. Wallace, 9XAX. 1XW to 9CGB 2/22 6:52 P.M., EST, to 9XAX 2/22 7:40 P.M., CST. Hurrah! A message got through in one night even though it had to go through another station.

Nr. 19—B. A. Ott, 9ZY. 1XW to 9CGB 2/22 6:55 P.M., EST, to 9XAX 2/22 7:45 P.M., CST, and mailed 2/23. When a message lands at 9ZT-9XAX, it doesn't linger 48 hours. Wallace moves them or mails them; the rest of us are supposed to, too.

Nr. 20—M. E. McCreery, 6LJ. 1XW to 6XBC 2/22 3:04 A.M., EST. Delivered in person 2/24 2:00 P.M. 6XBC reports it was delivered in person by him 2/22. One or the other is wrong.

Nr. 21—K. P. Frederick, Los Angeles. 1XW to 6XBC 2/22 3:09 A.M., EST. Delivered in person 2/23 5:00 P.M., PST.

Nr. 22—Major Borrett, Canadian 1DD. 1XW to 1XAR 2/23 7.15 P.M., EST, to Canadian 1DD 2/26 7:00 P.M. You held it a day too long, 1XAR!

Nr. 23—Toronto Star, Toronto, Ont. 1XW to Canadian 3OJ 2/24 5:46 P.M., EST, to Canadian 9AL 2/24 8:00 P.M. and delivered 2/25 4:00 P.M.

Nr. 24—E. F. MacDonald, Zenith, Chicago. 1XW to 9XBA 2/25 7:47 P.M., EST, delivered 2/26 10:00 A.M., CST.

Nr. 25—H. L. Gooding, 6FP-6ZZ. 1XW to 5AIC 2/26 12:11 A.M., EST, to 6ZZ 2/28 5:30 P.M., CST.

Nr. 26—K. E. Hassel, Chicago. 1XW to 9XBA 2/25 7:45 P.M., EST. Message was phoned 2/26 10:00 A.M., CST, but Hassel didn't get it until 3/3 stating that 9XBA gave the message to his sweetie over the phone but she held it several days. We have to take Hassel's word for it. Better tell your sweetie about holding messages longer than 48 hours, "FJ"—can't afford delays like that, OM.

Nr. 27—P. T. Bennett, Dallas, Tex. 1XW to 5AIC 2/25 11:54 P.M., EST, to 5ZC 2/26 4:30 P.M., CST, who delivered it in person 2/26. The only startling thing about this is the pleasant surprise that old kid Corlett is back on the air again. FB, 5ZC!

Nr. 28—W. E. Schweitzer, 9AAW. 1XW to 9XBA 2/25 7:51 P.M., EST. Mailed 2/26 10:30 A.M., EST. Delivered 2/27 OK.

Nr. 29—A. H. Babcock, San Francisco. 1XW to 8FM 2/28 11:09 P.M., EST, to 9EEA 3/3 1:00 A.M., EST, and mailed from there 3/3 9:00 A.M., MST, delivered 3/5 OK. 9EEA reports receiving this one from 8FM at 3:00 A.M., MST. Either 8FM or 9EEA is wrong as the two hours difference in time is the other way 'round.

Nr. 30—Routing not completed; will be reported later.

Nr. 31—G. L. Bidwell, Washington, D.C. 1XW to 3PZ 3/17 7:59 P.M., EST. Delivered 3/18 3:39 P.M. 3PZ has improved his delivery already—FB!

There is the story, fellows; no razzing is meant for anybody. The facts just happen to be as you see them and the complete file is being preserved. One thing is brought out very plainly—our messages seem to get through if you give them enough time and don't care what they look like when they arrive. It is going to pay some of you to keep a decent log and preserve records of the messages you handle for a month or two. Some of you might be a bit more careful with your sending and receiving—don't acknowledge a message at which you have merely taken a wild guess—get it right. And when you haven't relayed it within 48 hours, for the love o' Mike don't let it lay around accumulating moss while you are repairing your soldering iron or something—MAIL it!

Sooner or later some more of you are going to run afoul one of these messages which are being traced, and it will be to your advantage to be able to supply the information asked for, because this is t-o b-e c-o-n-t-i-n-u-e-d.

INTERNATIONAL AMATEUR RADIO

(Continued from page 57)

Italy

"L'Audion" (Italian). Organ of the Radio Club of Italy. A semi-technical journal of Italian radio progress. Published twice a month at Via dell'Alloro 19, Firenze, Italy. Single copies 2 lire. Yearly 50 gold francs.

Argentina

"Revista Telegrafica" (Spanish). A very interesting semi-technical review of radio and electrical progress. Has a section devoted to Radio Club of Argentina. Published monthly at Calle Peru 135, Buenos Aires, Argentine Republic. Single copies 40 cents. Yearly $2.00 o/s (Argentine money).

"Electron" (Spanish). An interesting radio telephone review. Has section devoted to Radio Club of Argentina. Pub-

lished monthly at Av. de Mayo 1035 Buenos Aires, Argentine Republic. Single copies 70 cents (Argentine money).

Brazil

"Radio" (Portuguese). A semi-technical review of radio information; the official organ of the Radio Society of Rio de Janeiro. Published twice a month. Editor, Carlos Sussekind de Mendonca, Rua de S. Jose n. 114, Rio de Janeiro, Brazil. Single copies 2.500 reis. Yearly 50.000 reis.

Germany

"Der Radio Amateur" (German), organ of the German Radio Club, an organization representing the transmitting and receiving amateurs in Germany, which was organized to promote interest in these things and to eventually secure the opening of a band of wave lengths for amateur transmission. The contributors number many of Germany's foremost radio men. This magazine is the "*QST*" of Germany. Published monthly for Eugene Nasper by Julius Springer and M. Krayn, Berlin. Subscription price adjusted in accordance with prevailing rate of exchange.

"Telefunken Zeitung" (German), the house organ of the Telefunken organization. It is splendidly printed, its contributors are internationally famous members of the organization, and the articles, while centered about Telefunken activities, are invariably informative and valuable. Distinctive departments are a book department confined to the review of German books and a monthly world-wide review of radio conditions in all lands, a unique and valuable feature not duplicated anywhere else. Published at Telefunkenhaus, Berlin S.W. 11, Hallesches Ufer Nr 12. Six issues per year. Price determined by multiplying 1 German mark by the current factor of the German Society of Bookdealers.

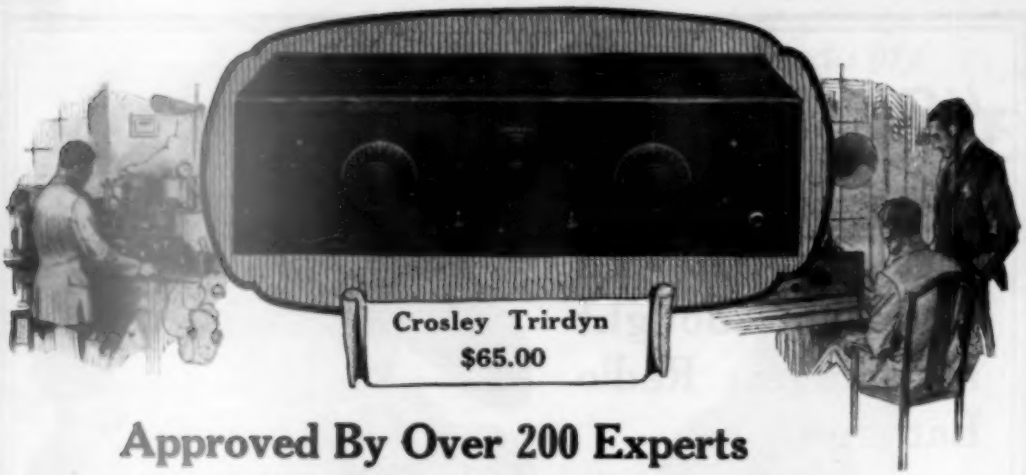
"Der Deutsche Rundfunk" (German). Purely a broadcasting magazine. Articles, however, have a technical tendency and are contributed by prominent engineers. Published monthly by Rothgiesser & Diesing A. G., Prinzenstrasse 98, Berlin S. 42. Price per year in America about $3.00.

"Radio" (German and some Spanish). Primarily a trade journal with interest mainly centered in Germany and Spanish America. The advertisers are German. Published twice a month by Rothgiesser & Deising A.G., Prinzenstrasse 98, Berlin. Price in America $2.00 per year.

AN AMATEUR IN THE LIGHTHOUSE SERVICE

(Concluded from page 40)

good, but unfortunately my list of calls heard was lost. I would surely like to hear from any of the fellows I worked, or who heard NASK's signals, and will gladly QSL. My present address is 125 Eastlawn Ave., Detroit, Michigan."



Approved By Over 200 Experts
New Crosley Engineering Achievement

A three tube set with five tube efficiency—the greatest selectivity with the minimum effort—positive calibration to any wave length between 200 and 600 meters. These are only a few of the many advantages offered in the remarkable new Crosley Trirdyn Radio Receiver.

It was only after a year of constant experimenting, that our engineering department perfected this exceptional receiver. Thorough tests proved to us that it would out-perform any receiver ever before produced. But we were not satisfied with our own opinion. So we shipped out 200 of these sets to experts in every part of the United States. Their criticisms are one and the same—"tried out your new Trirdyn Receiver Saturday night and logged 13 stations, among them Cuba, New York and Omaha, between 9 and 10 o'clock. The set was very selective. During the time this test was on, local station KSD was operating and we went through them without any difficulty or interference whatever. The range of the local station was not more than three points variation in the dial setting."

"Tried one of these sets out and obtained wonderful results. Were able to log all stations which we heard very successfully. This set should go over big." "The set has wonderful volume and is selective"—etc.

Licensed under Armstrong U. S. Patent No. 1,113,149

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Better-Cost Less Radio Products

Largest Builder of Radio Receiving Sets in the World

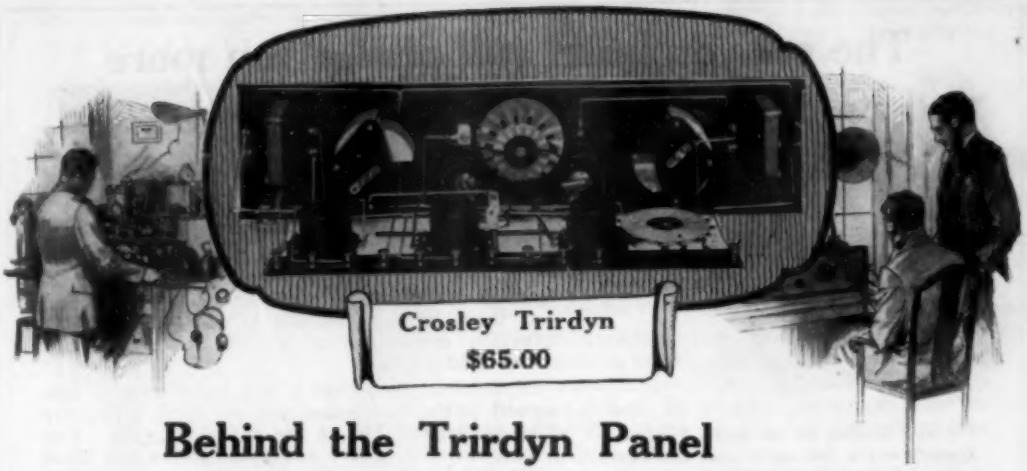
See this new wonder at your dealers

THE CROSLEY RADIO CORPORATION

Powel Crosley, Jr., President

Formerly The Precision Equipment Company and Crosley Manufacturing Company

518 ALFRED STREET, CINCINNATI, OHIO



Behind the Trirdyn Panel
Where the Extreme Efficiency is Built-in

This new Crosley triumph is called the Trirdyn because of its original combination of the three "R's"–Radio frequency amplification, Regeneration and Reflex. The first tube incorporates non-oscillating, non-radiating tuned radio frequency amplification; the second tube, a regenerative detector, reflexed back on the first tube for one stage of audio frequency amplification. Then it has a third tube which acts as a straight audio frequency amplifier. It uses the ultra selective aperiodic antenna circuit and external selector coil, which adds to its wonderful selectivity.

The Crosley Trirdyn in range, volume and selectivity is the equal of any five tube receiver on the market. Greater volume will, of course, be obtained through the use of storage battery tubes, but it will function well in any type and can be used with either indoor or outdoor antenna.

The opinions of many experts have convinced us that the Trirdyn is the best receiver ever offered the public regardless of price.

Practically every radio dealer can furnish you Crosley Radio Sets including not only the Trirdyn, but the Model 51, a two tube set for only $18.50; the Model V, a single tube receiver at $16.00; the Model VI at $24.00; the Super VI at $29.00; the Model X-J at $55.00 and the Super X-J at $65.00.

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CROSLEY
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See this new wonder at your dealers

THE CROSLEY RADIO CORPORATION

Powel Crosley, Jr., President

Formerly The Precision Equipment Company and Crosley Manufacturing Company

518 ALFRED STREET, CINCINNATI, OHIO

Get ready *now* for summer radio

A GREAT radio summer is at hand. To enjoy summer radio at its best, equip your receiver with the best batteries you can get. Put in new Eveready Radio "B" Batteries and see what wonderful, long-lived service they will give.

Made especially for radio use, Eveready "B" Batteries will operate the loud speaker at maximum volume for long or short periods, depending on how rapidly the current is taken out of them. Packed full of pep and punch and go, Eveready "B" Batteries pour out their power the moment you turn on the tubes.

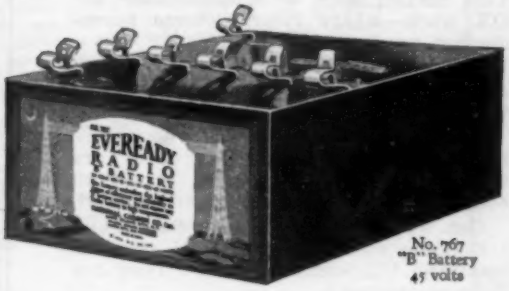
Eveready "B" No. 767 is the standard amplifier "B" Battery, and gives 45 powerful, dependable, zippy volts. Five sturdy Fahnestock Clips make this big "B" Battery available for detector tube use as well—varying the voltage from 16½ to 22½ as required.

Insist on Eveready "B" Batteries, remembering that they are the product of thirty years of experience and know-how in battery making. For maximum battery economy and service buy Eveready Radio Batteries—they last longer.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC.
Headquarters for Radio Battery Information
New York San Francisco

Canadian National Carbon Co., Ltd., Toronto, Ont.



No. 767
"B" Battery
45 volts

Storage
"A"
Battery

No. 766
"B" Battery
22½ volts

No. 7111
Dry Cell
"A"
Battery

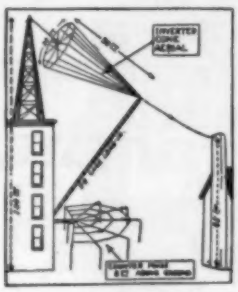
No. 764
"B" Battery

No. 771
"C" Battery

EVEREADY
Radio Batteries
—they last longer

Informative and money-saving booklets on radio batteries sent free on request. If you have any questions regarding radio batteries, write to G. C. Furness, Manager, Radio Division, National Carbon Co., Inc., 124 Thompson Avenue, Long Island City, N. Y.

Another wonderful testimonial for ACME Transformers



HAVERFORD COLLEGE
RADIO CLUB

HAVERFORD, PENNSYLVANIA

BROADCASTING CALL
WABQ

AMATEUR CALL
3-BVN

AFFILIATED WITH THE AMERICAN RADIO RELAY LEAGUE

February 8th, 1924

Mr. G.E.M. Bertram, Chief Engineer,
Acme Apparatus Co.,
Cambridge, Mass.

Dear Sir:-

We believe that you will be interested to know how well one of your 500 watt CW transformers stood up at a critical time during the broadcasting of the Haverford College Alumni Dinner from WABQ on February 2nd.

As we wished to reach alumni throughout the East, we used high power for the first time, and consequently over-loading the transformer. After the set had been in continuous operation for over an hour the transformer became so hot that the paper turned dark brown. We could not interrupt the program, so we decided to run it to the limit, as we expected the program to end within a short time. After an hour and a half the set was still "going strong" but the old transformer was smoking like a locomotive, and it seemed about to blaze up at any minute. The control operator in the dining-hall told us that the program would be over in fifteen minutes, so we hastily rigged up a little electric fan and turned it on the transformer, which by this time was nearly black from the intense heat. The fan helped, and we managed to keep the transformer going until we signed off, after more than two hours of continuous operation. During this time the transformer was heavily over-loaded, much more so than in any amateur station where the load is on for only a short time.

It is needless to say that we thanked the powers-that-be for the sturdiness of the transformer--and never again will we use high power for a two hour program.

Yours truly,
W. S. Halstead, Station Mgr.

ACME *for transmission*

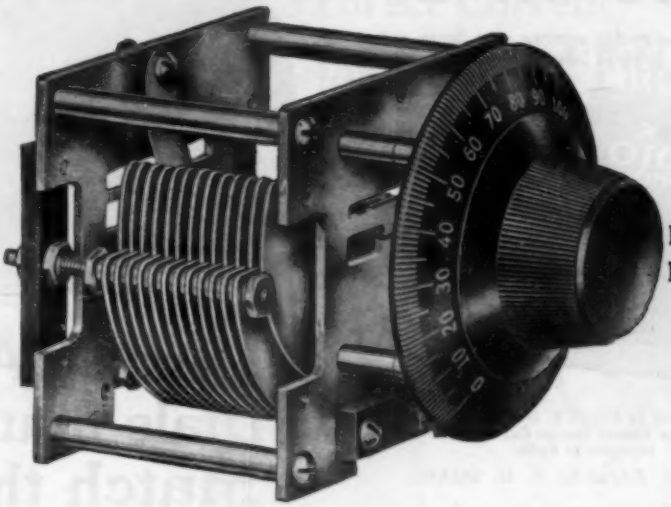
Send this Coupon

ACME APPARATUS CO.
Dept. 38, Cambridge, Mass.
Gentlemen: Kindly send me your latest catalog of:
[ ] Transmitting Apparatus
[ ] Receiving Apparatus
[ ] Booklet on Amplification without distortion.
(Enclose 10¢)

*Name*_____
*Street*_____
*City*_____
*State*_____

THE NATIONAL PERFECT VERNIER CONDENSER TYPE DX

Maximum Signal Strength



Minimum Loss

Tests Prove This Design Most Efficient

DESCRIPTIVE DATA

Capacity—maximum—MF	.001	.0005	.00035	.00025
Capacity—minimum—MF	.000018	.000016	.000014	.000014
Price, complete with Vernier Dial	$7.00	$6.00	$5.75	$5.50
Number of plates	45	25	17	13
Thickness of plates	.032	.032	.032	.032
Overall depth, panel to end	4.6″	3.3″	3″	2.75″
Height	3″	3″	3″	3″
Width	3.25″	3.25″	3.25″	3.25″
Weight with dial	18 oz.	15 oz.	13 oz.	12 oz.
Weight without dial	13 oz.	10 oz.	8 oz.	7 oz.
Rotor & Stator Plates	Aluminum			
Shielding plates	Special Alloy			
Shaft Diameter	.25″	.25″	.25″	.25″
Insulating Material	Low loss hard rubber			
Bearings, front & back	Double automatic and ball thrust adjustable			
Rupturing voltage at 60 cycle AC	1200 volts			
Equivalent series resistance at 89 meters (3380 kilo cycles)	less than 1 ohm*			

*No absolute value can be given as probable error in measuring apparatus was greater than the magnitude of the probable loss in the condenser.

THE NATIONAL COMPANY, Inc.
ENGINEERS & MANUFACTURERS
CAMBRIDGE, 39, MASS.
ESTABLISHED IN 1914

If you contemplate purchasing a condenser and your dealer has no Type DX condenser we make for a limited time, the following offer:—

The National Co., Inc., Cambridge, 39, Mass.

.....1924

Gentlemen:—

Find enclosed check M.O. for.....

for.....Type DX Perfect Vernier Condenser size..... I am to use it for five days and if not satisfied, I am to return it to you **carefully packed by Parcels Post insured**, and upon receipt of same you are to refund purchase price.

Very truly yours,

.....

Your pilot over the RADIO WAVES

Whatever the radio course you have set for yourself, here is your one best guide.

JUST OUT

—

514 PAGES

Compiled by **HARRY F. DART, E.E.**
Formerly with the Western Electric Co., and U. S. Army Instructor of Radio.

Technically Edited by **F. H. DOANE**

THIS is what you want in a radio book. It answers your every question as it occurs to you. Look up the thorough index, turn to the page, and there you are! The most complicated facts about radio and electricity explained as easily as the most simple ones.

Everything included. Compiled by an expert formerly of the Western Electric Co., the organization that knows most about radio in the world, and edited by another famous engineer. Understood by thousands of laymen because written especially for them. Yet—and here is the real marvel of this book—the advanced amateur, constructor and experimenter also find in it the data they need for calculating the constants of transmitters, receivers and associated apparatus for all radio purposes.

SOME OF THE FEATURES: Electrical terms and circuits, antennas, battery construction and maintenance, generators and motors, vacuum tubes (really explained), many receiving hook-ups, radio and audio frequency amplification, broadcast and commercial receivers, super-regeneration, codes, license rules, etc.

Send $1 to-day and get this 514-page I. C. S. Radio Handbook—the biggest dollar's worth in Radio. Money back if not satisfied.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6133-B, Scranton, Penna.

I enclose One Dollar. Please send me—postpaid—the 514-page I. C. S. Radio Handbook. It is understood that if I am not entirely satisfied I may return this book within five days and you will refund my money.

Name.....

Address.....

MAHOGANITE Dials that match the set

Like all other distinctive products, Mahoganite has its imitators. But, these imitations are on the surface only. Mahoganite is not a surface finish. The electrical values of Mahoganite extend through the material.

The only way to assure yourself of genuine Mahoganite Panels, or Dials which match the panels is to make sure that the RADION Trademark is on every one that you buy.

21 Stock Sizes

Mahoganite and Black

6 x 7	7 x 14	8 x 26
6 x 10½	7 x 18	9 x 14
6 x 14	7 x 21	10 x 12
6 x 21	7 x 24	12 x 14
7 x 9	7 x 26	12 x 21
7 x 10	7 x 30	14 x 18
7 x 12	7 x 48	20 x 24

RADION

The Supreme Insulation

PANELS

Look for this stamp on every genuine RADION Panel. Beware of substitutes and imitations.

AMERICAN HARD RUBBER CO.
11 MERCER ST. NEW YORK

Static Condensers

High-Voltage Direct Current

Specially Adapted for Radio "Filters"

3500 VOLT DIRECT-CURRENT UNIT

A Good C.W. Note or Clear Speech Transmission

depends upon uniform plate voltage.

A static condenser must be placed in the circuit, between the source of direct-current supply and the plate, to obtain satisfactory results in speech transmission or a good C.W. note.

Westinghouse Electric has developed a static condenser which meets fully all requirements of radio transmission.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of the
United States and Foreign Countries

Westinghouse

Licensed under Armstrong U. S. Patent No. 1,113,149

Eleven Degrees from the North Pole

Ice—endless miles of ice, as far as the eye can see. And frozen fast in the ice, amid the deadly stillness and the unearthly lights of the Arctic, a staunch little eighty-nine foot schooner! But Donald B. MacMillan and his band of brave explorers are not alone tonight.

Under their ice-bound hatches they listen eagerly to the news of the outside world, broadcast to them from the Zenith-Edgewater Beach Hotel Broadcasting Station, Chicago—to violins in Newark, Schenectady, Los Angeles—to singers in Atlanta—to a lively orchestra in Honolulu.

Stations in all these cities—and in several hundred others—they have readily tuned in; yet the Bowdoin tonight is only eleven degrees from the North Pole!

Out of all the radio sets on the market, Dr. MacMillan selected the Zenith exclusively—because of its flawless construction, its unusual selectivity, its dependability and its tremendous REACH.

And you can do all that Dr. MacMillan does, and more, with either of the two new models described at the right. Their moderate price brings them easily within your reach. Write today for full particulars.

ZENITH
TRADE MARK
Long-Distance Radio

Zenith Radio Corporation

McCORMICK BUILDING, CHICAGO, ILLINOIS

Model 3R The new Zenith 3R "Long-Distance" Receiver-Amplifier combines a specially designed distortionless three-stage amplifier with the new and different Zenith three-circuit regenerative tuner.

Fine vernier adjustments—in connection with the unique Zenith aperiodic or non-resonant "selector" primary circuit—make possible extreme selectivity.

2,000 to 3,000 Miles With Any Loud-Speaker

With the new Zenith 3R satisfactory reception over distances of 2,000 to 3,000 miles, and over, is readily accomplished in full volume, using ***any ordinary loud-speaker.*** No special skill is required. The Model 3R is compact graceful in line, and built in a highly finished mahogany cabinet **$160**

Model 4R The new Zenith 4R "Long-Distance" Receiver-Amplifier comprises a complete three-circuit regenerative receiver of the feed-back type. It employs the new Zenith regenerative circuit in combination with an ***audion detector*** and ***three-stage*** audio-frequency amplifier, all in one cabinet.

The Zenith 4R may be connected directly to any loud-speaker ***without*** the use of other amplification for full phonograph volume, and reception may be satisfactorily accomplished over distances of more than 2,000 miles **$85**

ZENITH RADIO CORPORATION,
Dept. 1C 328 South Michigan Avenue, Chicago, Illinois

Gentlemen:
Please send me illustrated literature on Zenith Radio.

Name .....

Address .....

MARLE

Radio & Audio Frequency

TRANSFORMERS

"The Heart of a Good Receiver"

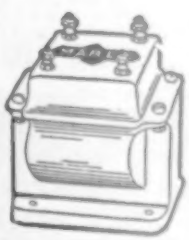
EQUAL to the widest range of reception requirements. *Marle Transformers* amplify the weakest broadcasting over frequencies all the way up to 3500 cycles without variation. Perfect tone quality. Utter absence of howling or distortion. To get the most out of radio—use *Marle Transformers.*

Specially adapted to the latest circuits, the SUPERDYNE, SUPERHETERODYNE, FOUR-CIRCUIT TUNER, NEUTRODYNE, INVERSE DUPLEX and any circuit that makes high requirements of a transformer.

Type A4
Audio F
Coretype
Ratio 3¾ to 1
$3.75

Type A9
Shelltype
Ratio 5 to 1
Audio F
$6.00

Type A8
Audio F.
Coretype
Ratio 5 to 1
$4.25



MARLE
Engineering
Comapny

Orange,
New Jersey

Audio F
Coretype
Type A7
Ratio 3¾ to 1
$4.50

Radio F
Types
R1 and R2
Coretype
$4.00

Kellogg Inductance Switches

Showing Construction and adaptability

Kellogg inductance switches are of unusual construction. The switch arm is silver plated to insure minimum resistance. The arm mounts securely on the shaft and a spring which is locked in place by two nuts, keeps the proper tension of the arm on the switch points at all times. The knob is of unique design and matches the knob of the Kellogg dial and rheostat.

No. 445 Switch

Write for our Bulletins on Kellogg Radio Apparatus Use—Is The Test

Ask your dealer for Kellogg Radio Equipment

KELLOGG SWITCHBOARD & SUPPLY COMPANY

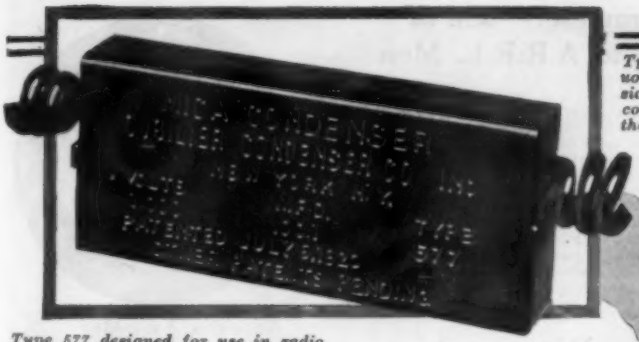
1066 West Adams Street
Chicago, Ill.

Some pippin!

A Celoron Radio Panel gives a snappy, professional appearance to the home-built set. Its high dielectric strength helps instruments give the best results. Celoron, a bakelite product, is approved by the U. S. Navy and Signal Corps and used by leading radio manufacturers.

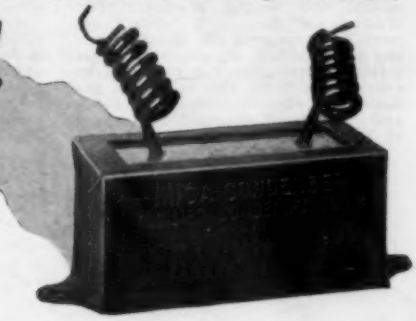
Celoron panels come *in nine standard sizes,* in black, mahogany or oak. Other sizes cut to order. *Ask your dealer.*

DIAMOND STATE FIBRE COMPANY
Bridgeport, Pennsylvania
Branches in Principal Cities
Toronto, Canada London, England



Type 577 designed for use in radio and audio frequency circuits; for receiving equipment (especially super-heterodyne); self-rectifying circuits; d.c. and other tube transmitters up to 100 watts. An excellent grid, plate by-pass and antenna series condenser.

Type 580 is designed for low-power continuous-wave telephone and telegraph transmission. It is used also as a tuning or coupling condenser, as a series or tuning condenser in the antenna circuit, or as a grid condenser.



Dubilier Condensers
for efficient Amateur Transmission

Dubilier Condensers Types 577 and 580 are preferred where low losses and accurate capacity condensers are essential.

The Dubilier patented method of manufacture embodied in these condensers assures permanent capacity under all service conditions. They are suitable for use as laboratory standards in precision circuits and for low power C.W. transmitters.

Type 577		Type 580	
Capacity in mfds.	Voltage	Capacity in mfds.	Voltage
.00025	1000	.001	5000
.0005	1000	.002	5000
.001	1000	.005	2500
.002	1000	.01	2500
.005	1000	.02	2500
.0075	1000	.0003, .0004, .0005 — These 3 capacities combined in one condenser	5000
.01	1000		

Other transmitting condensers are made to your specification for broadcasting purposes.

Complete information will be supplied on request.

DUBILIER CONDENSER AND RADIO CORP.

42-50 WEST FOURTH STREET, NEW YORK

The Weston Antennae Ammeter—one of seven especially valuable to A.R.R.L. Men

A.R.R.L men want the best there is in the market. In radio instruments, this means Weston. The Weston Electrical Instrument Company has pioneered the development and manufacture of electrical indicating instruments for 35 years in every branch of the electrical industry. Every instrument is guaranteed. One distinguishing feature of Weston instruments is that they are not only correct at zero and at full scale deflection, but at every other part of the scale as well.
This Weston Antennae Ammeter eliminates all troubles encountered in hot wire types—has no zero shift and is thoroughly compensated against changes in temperature. It is the adopted standard in commercial and government work. Flange diameter 3¼ in.

Antenna Ammeter

Weston Instant Change Plug

Weston Instant Change Plug

Interchangeable in two seconds. Shove cables in to connect. Press triggers to pull cables out. No tools. The choice of A.R.R.L. men everywhere.

Circular J is an attractive 24-page booklet that explains in detail all Weston Radio Instruments and shows instrument connections for both transmitting and receiving sets. Sent free on request.

WESTON ELECTRICAL INSTRUMENT CO., 158 Weston Ave., Newark, N. J.

Electrical Indicating Instrument Authorities Since 1888

WESTON

STANDARD - The World Over

The long-life tube!

(½ size)

$5

EACH

Complete with clips ready to mount on your set; no sockets or extra equipment required.

Since their inception, radio Vacuum tubes have been fragile. To knock or drop one incurred the expense of a new tube. But now there are

MYERS TUBES

Practically Unbreakable

—so protected by their unique design that they have been dropped on the floor without injury.

But their sturdiness is only one feature. They are the most perfect detectors and amplifiers obtainable. Smaller capacity and no bunched leads mean less interference—more clarity and greater amplification. Actual tests, all over the world, have proved their supremacy.

Two Types—Dry Battery and Universal (for storage battery). At your dealers' or send price and be supplied postpaid.

Write for free circuit diagrams.

Made exclusively by

F. B. Myers Co. Ltd.
Radio Vacuum Tubes

240 Craig St., W., Montreal, Canada

Approved by Public Demand

The huge sale of *U. S. Tool Condensers* proves that these condensers are RIGHT.

100% Guaranteed

End Plates of CELORON

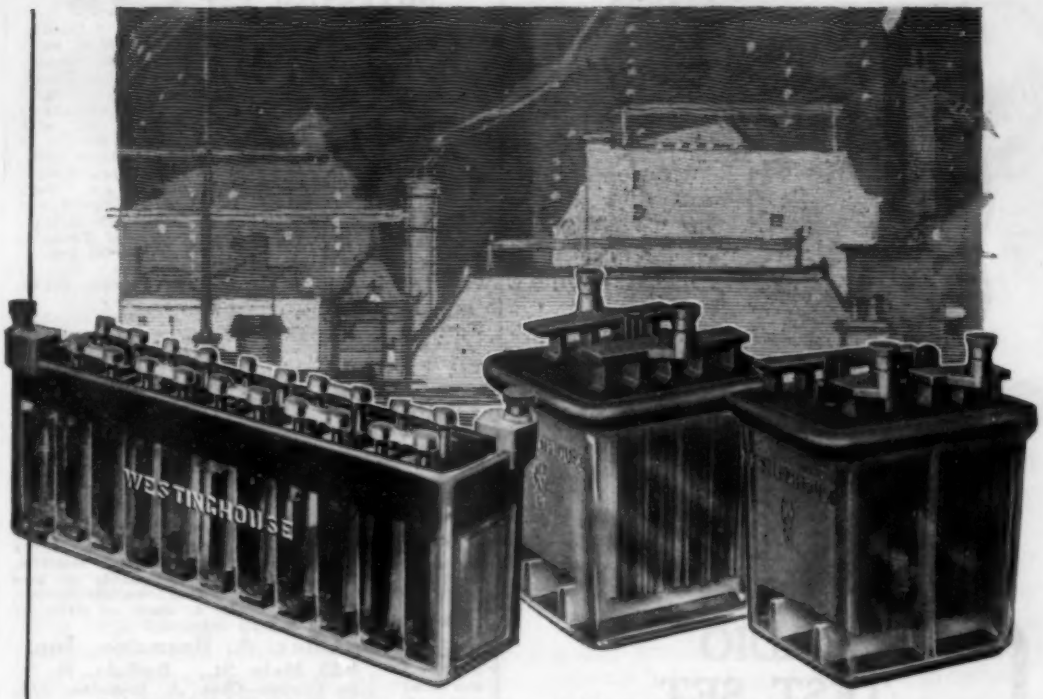
For Superheterodyne, Superdyne Inverse Duplex, Four Circuit Tuner

Use Vernier Cap. .00057 Mfd (24 Plate)
or
Plain Cap. .00055 Mfd (23 Plate)

Condensers of recommended capacity for all known circuits are also carried in stock by leading radio retailers.

Write for Booklet

U. S. TOOL COMPANY, Inc.
112 Mechanic St., Newark, N. J.



NOTHING about a radio set is so absolutely essential to satisfactory receiving as *good batteries.* Sustained voltage, slow, even discharge, ample capacity, utmost quiet, long life—these are important. Don't be satisfied with anything less than Westinghouse Radio Storage Batteries. They are built to meet the most exacting requirements of radio broadcast transmission and reception. And they last! Thoroughly insulated against current leakage. Easily recharged. A size and type for every radio need.

MAIL COUPON for interesting facts about batteries.

Westinghouse CRYSTAL CASE Radio Batteries have one-piece clear glass cases, with glass cell partitions and high glass plate rests (deep sediment spaces). "A" Batteries in 2, 4 and 6 volt sizes. 6-volt size made in rubber-case types too. "B" Batteries in 22-volt units—regular and quadruple capacities. "C" Batteries in 6-volt units.

WESTINGHOUSE UNION BATTERY COMPANY, Swissvale, Pa.

WESTINGHOUSE

RADIO

"A," "B" and "C" BATTERIES

Westinghouse Union Battery Co.
Swissvale, Pa.

Send me Westinghouse Radio Battery Folder A-3-D.

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PATTERN No. 95

RADIO TEST SET

¶ This radio test set has been designed to meet the demands coming to us from serious experimenters, manufacturers and dealers in radio equipment and supplies, for a complete radio testing outfit.

¶ While the various ranges of readings permit making practically every test necessary in connection with radio receiving sets, it has been particularly designed for the taking of characteristic curves on vacuum tubes, the only extra equipment required being the batteries.

¶ The several instruments, any of which may be used independently, include a 0-1.2 filament ammeter, a 0-6 filament voltmeter, a 0-120 plate voltmeter, a 0-10 plate milliammeter, and a 10-0-10 grid voltmeter.

Complete With Instructions

Price, $75.00

Send for Circular

ORDER FROM DEALER

JEWELL ELECTRICAL INSTRUMENT CO.
1650 WALNUT ST.
CHICAGO

BRANSTON KIT No.-R-99

Contains 1 Oscillator Coupler, complete with mounting brackets, bank wound inductance and adjustable coupling coil with locking device; 3 Intermediate Radio Frequency Transformers. Very sharply tuned and completely shielded; 1 Special Transfer Coupler for first or last stage of Intermediate Frequency; and 1 Specially designed Coupler for using Antenna. $36.50.

BRANSTON - GUARANTEED

This apparatus is of standard Branston Quality, rigorously tested and proved better than anything heretofore obtainable. Its efficiency and superior performance will delight you.

Our Book
"SUPER HETERODYNE CONSTRUCTION"

An up to the minute guide written by a leading authority on Super Heterodyne Construction. Just what it's name implies, a working hand book explaining the construction and operation of a Super Heterodyne Receiver. No lengthy discussions. No perplexing technicalities. No red tape. Completely illustrated with working blue prints. (One Dollar.)

Add miles and smiles With Branston Radio parts.

The amateur can easily make a complete and efficient Super Heterodyne Receiver that will be extemely selective, give remarkably fine quality of tone and be noticeably free from interference. See your dealer at once, or write us today for all information.

Chas. A. Branston, Inc.
823 Main St., Buffalo, N. Y.
In Canada—Chas. A. Branston, Ltd., Toronto, Ont.

Tested and Listed as Standard by Underwriter's Laboratories

FANSTEEL

Balkite

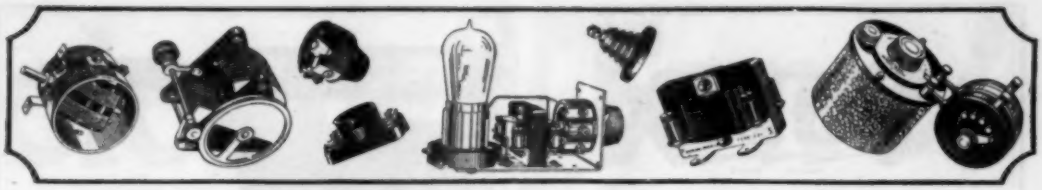
PATENTS APPLIED FOR *Battery Charger*

NOISELESS and INDESTRUCTIBLE

A new battery charger for Radio "A" (6 volt) batteries. Entirely noiseless. Has no moving parts, requires no attenton or adjustment, and cannot get out of order. No bulbs to break. Simple and unfailing in action. Can be used while the radio set is in operation. A positive economical charger for home use. Can also be used to charge "B" and automobile batteries. If your dealer can't supply you, sent direct on receipt of price. Money back guarantee.

Price $19.50 ($20 West of Rockies)

Dept. Q4 Fansteel Products Co., Inc.
North Chicago, Illinois



Standards of Excellence

GENERAL RADIO COMPANY

"Products of Proven Merit"

Type 231-A Audio Transformer

The first closed core transformers on the market available for use in broadcast receivers were built by the GENERAL RADIO COMPANY, nearly a decade ago.

Today the type 231-A is the standard of excellence in transformer construction.

Thousands of these transformers are in use by fans throughout the entire radio world. They have proven a source of delight to "listeners-in" everywhere because of their volume and quality of amplification.

Many of the leading manufactured broadcast receivers are using GENERAL RADIO CO. transformers as standard equipment—because of their unfailing satisfaction.

Whether you are building a set or buying one, the question of "Quality Amplification" will be settled once and for all if you insist upon the GENERAL RADIO CO. transformers.

PRICE—$5.00

Winding Ratio 3.7 to 1.

Type 247-H Variable Condenser

The 247-H geared variable condenser is the product of extensive laboratory research by skilled radio engineers. In its design are incorporated features which promote the utmost electrical and mechanical efficiency.

Its method of vernier adjustment is particularly commendable.

By using the counter-balanced gear, operated by a pinion, capacity may be accurately controlled to a minute degree—thus making possible extreme selectivity.

Its bearings are smooth running and its dielectric losses are low.

Due to its critical capacity control and general over-all efficiency, the 247-H condenser is readily adaptable to use in a wavemeter and filter as well as in the receiver circuit.

Capacity of the 247-H condenser .0005 microfarad.

PRICE—$5.00

Impedance Ratio 10 to 1.

Write TODAY for our Instructive Folders on "Quality Amplification" and "Quality Condensers" and our new Radio Bulletin 917-Q

GENERAL RADIO Co

Manufacturers of

RADIO AND ELECTRICAL LABORATORY APPARATUS

Massachusetts Ave and Windsor St.

CAMBRIDGE MASSACHUSETS

clearer Tone!

N & K Phones are designed for just one purpose—the *natural reproduction* of musical tones. They are sold under a guarantee to reproduce both high and low tones more clearly, with greater naturalness and mellowness. They will not increase the loudness of weak signals—because *all* the tones, high and low, have to be kept in *natural proportion*, to secure such mellowness as N & K gives. It's the job of your radio *set* to give volume.

Fans and mere beginners alike are enthusiastic over N & K's wonderful clearness. Out of several hundred amateur stations that tested N & K Phones last year, a full 90 per cent pronounced them the best they had ever used.

"Entirely free from mechanical sounds" says Station 1PX. "Exclude noise of visitors moving around operating room" says Station G.R.R. "Tone soft and clear as a bell" says 1FI; and so on. We will gladly send you our new folder reproducing other comments from fans and telling the real reasons *why* N & K Phones reproduce more clearly than other phones. *Write now.*

N&K

"KING OF THE AIR"

TRADE MARK

PHONES

N & K Head Set, Model D, 4000 ohms, is a remarkable example of skillful workmanship. Made of nickeled brass, with hard rubber ear caps, accurately machine threaded to insure proper seating of diaphragm. A special device insures uniform spacing between diaphragm and magnet poles. Magnets of finest German steel, wound by entirely new method. Sanitary headband, covered with genuine leather. Six foot cord. Price, $5.50.

TH. GOLDSCHMIDT CORP.
Department Q5
15 William Street
New York, N.Y.

DEALERS:—N & K Phones are being backed by a wide advertising campaign that is already bringing a big increase in sales. Until the announcement of our complete distributor organization, we will see that you are promptly supplied with N & K Phones if you order direct from us. N & K comes packed in cartons of ten with advertising display cards for window and counter and leaflets. Write or wire for carton today.

MU-RAD RECEIVER

MA-15

STILL FURTHER beyond the accepted bounds of radio reception, this long-range MU-RAD Receiver, MA-15, has extended the domain of radio entertainment. To the easy operation and high selectivity of the MU-RAD design, is added a still greater mastery of illimitable spaces together with pure, clear loud speaker volume. All this with only a handy 2 foot loop! The standard MU-RAD circuit of proven performance—two stages of audio and three stages of radio frequency amplification with detector. Adam Brown, hand-rubbed finish mahogany cabinet with voltmeter for quick reading of "A" and "B" battery conditions.

Guaranteed range with 2 foot loop—1000 miles

Write for Literature

MU-RAD LABORATORIES, INC.
804 FIFTH AVE. ASBURY PARK, NEW JERSEY

BRISTOL

TRADE MARK

AUDIOPHONE

REG. U. S. PAT. OFFICE

LOUD SPEAKER

This is known everywhere as the Loud Speaker with the quality tone. Not only is the tone natural and without mechanical distortion, but is sufficiently big in volume to be easily heard in a large room or all through the house. Comes to you ready to use—no auxiliary batteries are required.

Made in three models:

Audiophone Senior
Price $30.00

Audiophone Junior
Price 22.50

Baby Audiophone
Price 12.50

Bulletin AX-3014 describes these Loud Speakers.

This is the Baby Audiophone equipped with the Fiber Horn which is now standard and supersedes the metal flare previously used. Price $12.50

THE BRISTOL COMPANY
WATERBURY, CONN.

"I would not use any other Battery after K I C - O"

says Frank W. Harris, a Radio Fan of Ottawa, Canada. KIC-O Storage "B" Batteries will improve any Radio set. Try one on yours. Our Guarantee protects you. The life is unlimited. Recharge from any 110 volt A.C. line with small home rectifier.

GUARANTEE

Your money back on any KIC-O Battery if not satisfied within 30 days' trial. Write for full information on "A" and "B" Batteries.

KIC-O Storage "B" Batteries, Long Service. Low Cost.

Volts	Price Plain	With Panels
22	$5.50	$. . . .
32	7.25	11.75
48	9.50	14.00
68	12.50	17.00
100	17.50	22.50
145	23.50	28.50

Unmounted Rectifier.....$1.00
Mounted Rectifier.....$2.50

KIMLEY ELECTRIC COMPANY, INC.
2666 Main St., Buffalo, N. Y.

KIC-O STORAGE "B" BATTERIES

To Our Readers Who Are Not A.R.R.L. Members

Wouldn't you like to become a member of the American Radio Relay League? We need you in this big organization of radio amateurs, the only national amateur association that does things. From your reading of *QST* you have gained a knowledge of the nature of the League and what it does, and you have read of its purposes as set forth on page 6 of every issue. We would like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio, and incidentally you will have the membership edition of *QST* delivered at your door each month. A convenient application form is printed below—clip it out and mail it today.

.....1924

American Radio Relay League,
Hartford, Conn.

Being genuinely interested in Amateur Radio, I hereby apply for merbership in the American Radio Relay League, and enclose $2 in payment for one year's dues. This entitles me to receive *QST* for the same period. Please begin my subscription with the.....issue. Mail my Certificate of Membership and send *QST* to the following name and address.

.....

.....

.....

Station call, if any.....

Grade operator's license, if any.....

Radio Clubs of which a member.....

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may write to him too about the League?.....

.....Thanks.

Pioneers in the development of sound reproducing and amplifying equipment

THE new model R3 is distinguished by two important features—a Volume Control, and reduction of current consumption to a point where it need no longer be taken into consideration.

THIS instrument sets a new and higher standard of adaptability, refinement and also economy of operation. By means of the new Volume Control, reproduction can be adjusted at any degree from very loud to very soft.

R3—(As illustrated) with Volume Control	$35.00
R2—(*New Model*) with Volume Control .	50.00
M1—Requiring no battery for its operation	35.00

Magnavox Reproducers, Power Amplifiers and Combination Sets may be had of good Dealers everywhere. Write for catalog.

THE MAGNAVOX CO., OAKLAND, CALIF.
New York Office: 350 WEST 31ST STREET

Canadian Distributors: Perkins Electric Limited, Toronto, Montreal, Winnipeg

MAGNAVOX PRODUCTS

There is a Magnavox for every receiving set

5R

Clear from the skies

You can get greater clarity with a good storage battery than by any other means. If you are in any doubt about this important matter, try some friend's set that is hooked up to an Exide Battery.

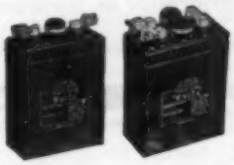
It is a fascination to see how far distant a station you can tune in, but still more fascinating to get it so clearly that you actually enjoy the concert.

Two things to remember

There are two things to remember about Exide Batteries: They give uniform current over a long period of discharge. This means not only clear reception but economy.

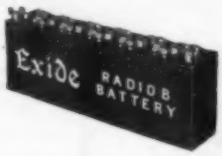
The second thing to remember is that there is an Exide Radio Battery made for every type of tube. In addition to the "B" battery there are Exide "A's" for 2-volt, 4-volt and 6-volt tubes.

From the "midget" five-pound battery for low-voltage tubes to the larger battery for six volts, each Exide is powerful, rugged, silent, and so long-lasting that it makes for true economy.



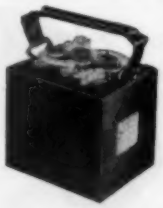
For low-voltage tubes

Specially designed for WD-11 and UV-199 vacuum tubes, but can be used with any low-voltage tube. The two-volt Exide A Battery consists of a single cell. It will heat the filament of a WD-11 or other quarter-ampere tube for approximately 96 hours. The 4-volt A battery, having two cells, will light the filament of a UV-199 tube for 200 hours.



Exide "B" Battery

Exide
RADIO BATTERIES



For six-volt tubes

Made in four sizes—of 25, 50, 100, and 150 ampere hour capacities. Like all Exides this battery is conservatively rated. It has extra-heavy plates assuring constant potential over a long period of discharge.

And the reason is obvious

The Exide Radio Battery results from experience in the radio field dating far back of amateur radio. In fact, a majority of all government and commercial radio plants are equipped with Exide Batteries. The giant dirigible Shenandoah and the great ship Leviathan are Exide-equipped.

Go to any radio dealer or Exide Service Station and ask for Exide A and B Batteries. If your dealer cannot supply you with free booklets describing the complete Exide line of radio batteries, write to us.

THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA

In Canada, Exide Batteries of Canada, Limited, 133-157 Dufferin Street, Toronto

Two Radio Parts

That Should be

Parts of Your Set

Paragon Variometer No. 60

Reduces dielectric losses to the minimum. Possesses the ideal advantages of coils surrounded by air and at the same time essential mechanical strength. Meets the rigid electrical requirements of Paragon Parts. Gives better results. Price $5.00.

Paragon Variocoupler No. 65

Strongly made with coils of double silk covered wire wound on moulded black Condensite tubes with highly polished finish. Single turn taps and switch are unnecessary. Makes possible a very fine control. Simple to operate. Price $3.50.

Write for illustrated catalog

ADAMS-MORGAN COMPANY

4 Alvin Ave., Upper Montclair, N.J.

PARAGON

Reg. U. S. Pat. Off.

RADIO PRODUCTS

MR. BOWDEN WASHINGTON OF THE

Cutting and Washington RADIO CORP'N

says: "All-American Audio Frequency Transformers were adopted as standard for the Cutting and Washington Receiver after thorough tests in our laboratories demonstrated that they faithfully reproduce broadcasted music and voice with excellent volume and stand up in service better than any other transformers we have tested. We consider All-American Audio Frequency Transformers the best on the market."

Many other leading set builders have similarly standardized on the best the market affords: All-Americans! Benefit by their experience. Add All-Americans to your set now. Dealers everywhere.

RAULAND MFG. CO.

2642 Coyne St., Chicago

Pioneers in the Industry

ALL-AMERICAN

AMPLIFYING TRANSFORMERS

Largest Selling Transformers in the World

A TRIPLY GOOD BUY

The type A.B-FF charger performs three duties economically. Charges radio 2, 4 or 6 volt "A" battery, radio "B" battery up to 120 volts and auto batteries. Average cost per charge about a nickel. Solidly built—will not get out of order. Fool-proof and simple. The first successful charger—introduced over ten years ago. Type A.B. price $20, West of Rockies $22; Type 6 for 6 volt "A" or auto batteries, price $15; West of Rockies $16. B Battery charging attachment $2.50 extra.

Write for New Bulletin on station calls, battery upkeep and wiring diagrams of basement installation of batteries. We will send dealer's name.

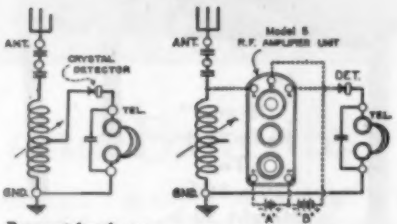
THE FRANCE MFG. CO.

10431 Berea Road, Cleveland

How to get increased distance with your crystal set

with

BALLANTINE VARIOTRANSFORMER *UNITS*



Present hook-up tunes broadly — *Revised hook-up*

YOUR crystal set is the starting point on which to build a good distance receiver. For authorities agree that there is nothing finer than a good crystal for clean-cut detection—not so loud as a tube, perhaps, but much clearer. Simplicity itself is the crystal. And its improved modern forms and mountings make adjustment easy. By all means, keep this element with which you are already familiar.

Use tubes to best advantage

Tubes, of course, are needed for amplification—to build up weak distant signals so that they may operate your crystal detector. But, by putting your money for tube equipment into one or more stages of radio frequency amplification, tuned with BALLANTINE VARIOTRANSFORMER Units, you will get increased distance. And with this method there comes a greater selectivity, accompanied by a reduction of interfering noises. In fact, BALLANTINE amplification into a crystal detector may be made as clear as a victrola. Furthermore, the full possibilities of your tubes may be developed without annoying your neighbors.

Complete radio frequency amplifier unit with socket and rheostat $15.00

Transformer only for panel or base $9.60

At dealers or postpaid

Easy changes quickly made

The above diagrams show how one popular make of crystal set can be brought up to date quite readily—only a slight rearrangement of wiring to hook in the first BALLANTINE Unit. And it's just as easy with any other crystal hook-up. Additional BALLANTINE Units may be inserted from time to time.

Try this instrument. Then, if there's anything you don't understand, our staff engineers will help you out.

Booklet tells how to improve crystal sets

"Radio Frequency Amplification with the BALLANTINE VARIOTRANSFORMER," is the title of our 25-page booklet, packed with useful data, charts and diagrams. Send for your copy now.

BOONTON RUBBER MFG. CO.
Pioneers in Bakelite Moulding
124 Fanny Road, Boonton, N. J.

RADIO FREQUENCY AMPLIFICATION with the BALLANTINE VARIOTRANSFORMER

SIGNAL RADIO TABLE

"Signal"
Radio Table
Top
20 x 36 in.
Height 30 in.

This table is especially designed for radio. The compartment is 12 in. high with two doors opening full length. The table top is 20 in. wide x 36 in. long, and the height is 30 in. The legs are 1½ in. square brass capped with casters.
A durable piece of high class furniture, $22.00.

SIGNAL Electric Mfg. Co.

Factory and General Offices:
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Boston, Chicago, St. Louis, Cleveland, San Francisco, Minneapolis, Toronto, Montreal, Philadelphia, New York, Los Angeles, Pittsburgh,
You'll find our local address in your Telephone Directory

A cross-section cut through a receiver of the Stromberg-Carlson Radio Head Set reveals the layer wound and layer insulated coils. Stromberg-Carlson coils are wound a layer at a time with a wrapping of tough insulating material between layers, and are used exclusively in

Stromberg-Carlson

Radio Head Sets

This high grade coil construction combined with powerful magnets ensures permanent sensitivity, fine tonal quality, and enables these Head Sets to stand up under the high plate voltages now prevalent.
Our 30 years' experience is your warrant of quality and service.
Send for booklet 1029 QST, which tells more about these superior Head Sets.

Sold by dealers everywhere
Stromberg-Carlson Telephone Mfg. Co.
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RADIO TUBE EXCHANGE

We Repair All Standard Makes of Tubes, Including

W.D. 11 or 12
U.V. 199 or C299
U.V.201A or C. 301A
C. 11 or 12
D.V. 1 or D.V. 2
U.V. 200 or 201
C. 300 or 301

$2.50

All tubes guaranteed to do the work.
RADIO TUBE EXCHANGE, 200 Broadway, New York
All Mail Orders Given Prompt Attention
Orders Sent Parcel Post C. O. D.

Have you tried it?

Chelten Midget Vernier

You've often wished for a closer capacity adjustment of your variable condenser. Here it is—the Chelten Midget Vernier. The 13 tiny plates and air spaces give sharp tuning. Costs but $1.50.

A Precision Instrument

CHELTEN ELECTRIC CO.
4861 Stenton Avenue - Philadelphia

Amateurs

the Opportunity of a Lifetime:

Western Electric

TRANSMITTING AND RECEIVING SETS

Type CW 1058

Original Cost $1,200.00

THESE Instruments were used during the war on D.H. planes. Each set consists of

1—3 Western Electric Ballast Lamps.
2—8 Western Electric V.T.1. Tubes and 2V.T.2's.
3—Westinghouse Generator.
4—Western Electric Control Box.
5—Western Electric Transmitter and Receiver.
6—2 Western Electric Headsets.
7—2 Western Electric Microphones.
8—Necessary accessories for setting together.

Will Transmit to a radius of 50 miles. In some cases these sets have been known to reach about 200 miles.

Will Receive on wave lengths from 215-450 meters and has good receiving range. Every set is absolutely new and comes in the original wooden packing cases, as shipped by the Western Electric Company.

198.50

Western Electric MICROPHONES

Talk thru your own set. Two types—one with breast-plate, shoulder-straps, cord and plug; other, larger size for mounting or suspending.

1.50

WESTERN ELECTRIC Telephone and Telegraph Sets

Originally made for the U. S. Govt. Signal Corps. Each comes with phone receiver, variometer, potentiometer, 3 throw switches, telegraph key and condenser.

5.00

Shipped prepaid anywhere in U. S. No Stamps or Checks Money Orders Only.

References: Hamilton Nat'l Bank, N. Y. C. Pacific Bank, N. Y. C.

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How Many Amperes Are You Radiating?

A Roller-Smith type TAW Thermal Ammeter will tell you accurately and it will *continue* doing so. These little 3½" instruments have demonstrated their reliability in the Government service. You can't make a mistake when you use them. Bulletin No. AG-10 is yours for the asking. Send for it. This Bulletin also describes a most complete line of ammeters and voltmeters for *all* radio work.

ROLLER-SMITH COMPANY
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Offices in principal cities in U.S. and Canada

Build Your Own SUPER!

3 BLUE PRINTS with the Super-heterodyne Manual $1.50

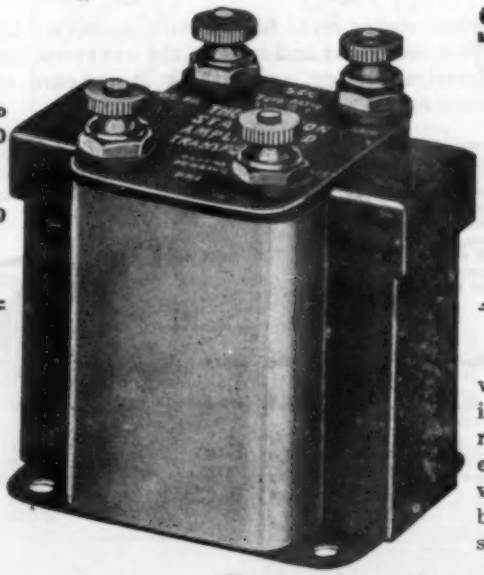
Biggest Value in construction aid ever offered! Victor Greiff's big text book complete and three full-sized blue prints,—tells how to build 3,000-mile, loop Super-Heterodyne. Order today.

RADIO RECEPTOR CO.
Dept. Q 57 Banks St. New York

THE PERFECT REPRODUCER

3½-1 Ratio
$4.00

6-1 Ratio
$4.50



SUPER TRANSFORMER

Audio Frequency

Did you ever think what a vital part of your phonograph is the little reproducer which rides on the record? The most elaborate phonograph made, with a poor reproducer, would be worthless as a musical instrument.

The reproducer of your radio set is your amplifying transformer. The musical qualities of your set depend largely upon the ability of your transformer to exactly duplicate the incoming signals.

Many manufacturers of amplifying transformers have been devoting their entire efforts in developing great amplification regardless of tone quality.

Thordarson amplifying transformers are designed and built with one primal aim,—perfect reproduction. The Thordarson super transformer is a product of the combined efforts of Thordarson engineers and nationally known tone experts and musicians, who were satisfied with only the best musical reproduction obtainable.

Thordarson amplification puts the finishing touches into your receiver,— that "breath of life" which you have so long sought. It actually brings the broadcast artist into your home.

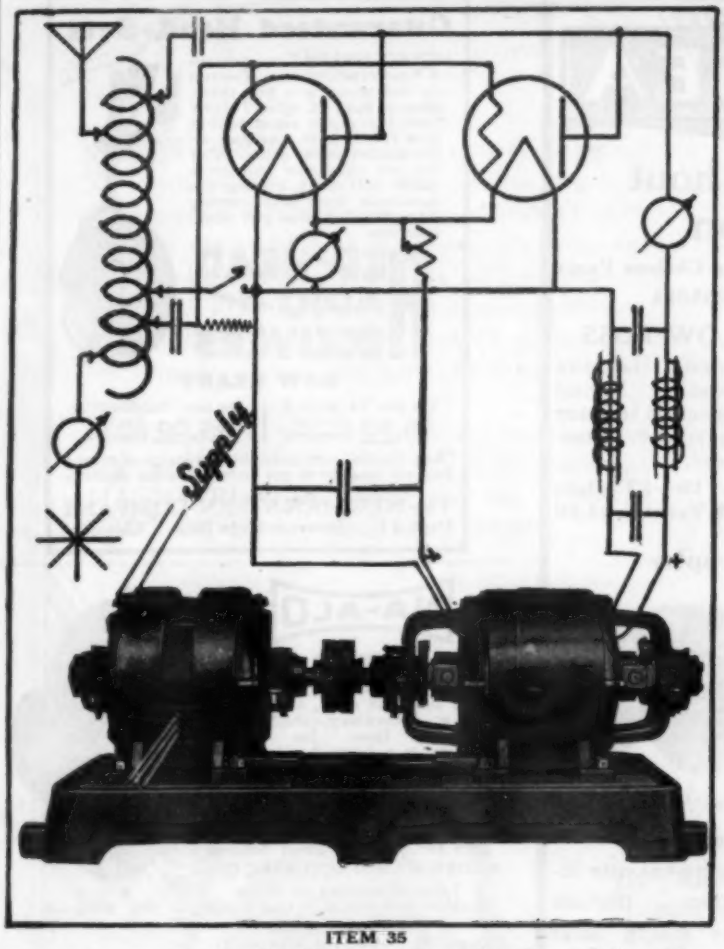
Leading manufacturers of receiving sets, such as Kennedy, Zenith, Cutting & Washington, Radiodyne, and many others, use Thordarson transformers.

Ask to hear a set using the Super Transformer and you will be convinced.

Even Amplification over the entire musical range

THORDARSON
ELECTRIC MFG. CO.

CHICAGO ILLINOIS



ITEM 35

Motors
Dynamotors
Generators
Motor-Generators

Used by more than 150 Universities—Colleges— Research Labs., etc. Many Federal — State — County and Municipal Depts.

Write for Bulletins 237B and 242A listing over 200 combinations

Send us your problems — we'll help you solve them.

A Few Good Combinations

Item			Description		Recommended for	
2	350	V	40 Watt		2-5	watt with separate Fil. supply.
7	500	V	100 Watt		4-5	watt with separate Fil. supply.
8	500	V	150 Watt		5-5	watt 2 mod. 1 mast. osc.-2 osc. sep. Fil. supply,
13	1000	V	300 Watt	dbl. comm.	2-50	watt with separate Fil. supply.
15	1000	V	500 Watt	dbl. comm.	3-50	watt or 2-50 watt and 4-5 watt as speech amplifier and mast. osc. sep. Fil. supply.
16	1000	V	650 Watt	dbl. comm.	4-50	watt with separate Fil. supply,
20	1500	V	600 Watt	dbl. comm.	2 to 3-50	watt with separate Fil. supply,
24	2000	V	500 Watt	dbl. comm.	1-250	watt with separate Fil. supply,
26	2000	V	1000 Watt	dbl. comm.	2-250	watt with separate Fil. supply,
31	500	V	100 Watt	-10 V 60 watt	Same as item 7	but with Fil. supply.
35	1000	V	300 Watt	-12 V 150 watt	Same as item 13	but with Fil. supply.
41	2000	V	500 Watt	-14 V 200 watt	Same as item 24	but with Fil. supply.

Many other sets for various combination of tubes.

Special sets made to order.

Trade "ESCO" Mark

ELECTRIC SPECIALTY CO.

225 South St., Stamford, Conn., U.S.A.

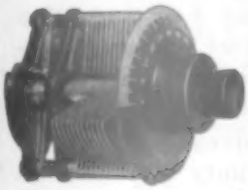
Pioneers in Developing and Perfecting High Voltage Wireless Apparatus

CHELSEA

Volume Without Distortion

Can best be secured by using Chelsea Parts

Variable Condensers



LOW LOSS

Genuine bakelite insulation Pigtail connection to rotor Absolutely guaranteed.

No. 10—23 plate with Vernier, $4.50

No. 95 Variocoupler

Stator and rotor wound on genuine bakelite tubing. Pigtail connections to rotor and taps on stator brought to binding posts. Will give maximum results in any circuit. Panel mounting.

Price without dial, $3.50; with dial, $3.95

Amplifying Transformer

Genuine bakelite insulation. Highest grade silicon steel core. Tested to 500 volts. Easy to assemble in your set. Ratio 3¾ to 1.

Price $4.50

No. 60 Bakelite Socket

The base of this socket is genuine moulded bakelite and supports four readily accessible binding posts. The tube receptacle is highly polished nickel and will take any standard make of detector or amplifier tube.

Price, $0.75

At your dealers or write direct

CHELSEA RADIO COMPANY

175 SPRUCE ST., CHELSEA, MASS.

Guaranteed Head-Sets

"RED-HEADS" are *guaranteed* radio phones. You run no risk when you buy them. Money back if, after 7 days' trial, you're not satisfied that they're the *best* receivers on the market at the price. Why not act *right now* and get a pair? It'll mean getting the *maximum* from broadcasting from the day you put them into use.

RED-HEAD RADIO RECEIVERS

NOW READY

The new '24 Model F $6.50 Per Pair Complete | The new "Red-Head" Jr. $5.00 Per Pair Complete

"Red-Heads" sent prepaid on receipt of price if you are unable to get them at your dealer's.

The NEWMAN-STERN COMPANY

Dept. Q 8 Newman-Stern Bldg. Cleveland

NA-ALD

When phonographs were first made they were square boxes without ornamentation. Likewise the first dials, turned out in a laboratory,—had hard straight lines for shape. Beauty is a later development. Na-ald dials have soft, graceful lines which makes them very pleasing to the eye. They lead in both beauty and quality. They have the right grip for delicate, exact tuning.

ALDEN MANUFACTURING CO.

Largest makers of Radio Sockets and Dials in the world

Springfield, Mass.

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3 inch

No. 3003—4

35c, 3 for $1.00

$3.50

THE LITTLE WONDER

The smallest, yet most efficient Transformer ever made. Maximum reproduction value, minimum distortion, 100% shielded.

PREMIER "HEGEHOG" AUDIO TRANSFORMER

Mounts anywhere—save space in assembly. We guarantee it unconditionally. Try them in your next "hook up." Ratio 1 to 3, 1 to 4, 1 to 5, $3.50; 1 to 10, $4.50.

Ask your dealer. Write for bulletin No. 92

Premier Electric Company

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Use — Price 75¢

Variable Grid Leak

At dealers, or postpaid

Durham & Co., 1936 Market St., Phila.

MAGNATRON is a name that is synonymous with vacuum tube quality. When you purchase a vacuum tube bearing the MAGNATRON seal you are purchasing the result of pioneer research work and long and costly experimentation. MAGNATRON vacuum tubes know no superior. They will give good results in ANY circuit, they will bring in stations which you have never heard before.

MAGNATRON vacuum tubes are priced at the new low list of $5. At this price both the MAGNATRON DC 201A and the MAGNATRON DC 199 are outstanding values.

ASK YOUR DEALER

for MAGNATRONS. Every good dealer sells them.

CONNEWEY ELECTRIC LABORATORIES

309 Fifth Ave. New York City.

GOOD TOOLS FOR GOOD WORKMEN!

The up-to-date League Member needs a complete stock of A.R.R.L. Tools".

The full list is given below. Don't risk being out of an article when you may need it most. Order a good supply NOW.

The A.R.R.L. EMBLEM. The outward badge of the true amateur. Now, as never before, should every A.R.R.L. man wear the black and gold diamond that tells the world who and what he is—and gives him a definite and honorable place in the eyes of all intelligent observers. **The A.R.R.L. Emblem, in extra heavy rolled gold and black enamel, may be had by League members, in either lapel button or brooch pin mounting, postpaid for $1.00.**

CUTS OF THE LEAGUE EMBLEM, to print as illustrated above. Used on your Stationery and report postals, etc., your standing as a real amateur, an A.R.R.L. man, will be carried wherever the mail penetrates. **League Members can buy a cut of the "A.R.R.L. Diamond" at $1.00, postpaid.**

OFFICIAL A.R.R.L. MESSAGE BLANKS. As necessary as his key to every transmitting "ham." **Pads of 100, 35c, or 3 pads for a dollar, postpaid.**

LEAGUE LETTERHEADS. When your tube's blown and you write instead of radio—do it on an A.R.R.L. Letterhead. It will add prestige and dignity to your correspondence. **To members at the following prices: 1000 sheets—$6.00; 500—$3.25; 250—$1.70; 100—$0.75.**

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MESSAGE DELIVERY CARDS. Ready to be filled out and mailed. On U. S. Stamped Postals, 2c each; 1c apiece without stamp (for Canadians etc.) Postpaid anywhere. Stock up now!

A.R.R.L. LOG SHEETS. A necessity in every shack. Designed by hams for hams. 8½ x 11″ bond paper, punched for standard 3-ring loose leaf binder. **125 sheets postpaid, $1.00; 500 for $3.50.**

Please address all correspondence to **QST** or **THE AMERICAN RADIO RELAY LEAGUE** at

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HAM-ADS

Six cents per word per insertion in advance. Name and address must be counted. Each initial counts as one word. Copy must be received by the 1st of month for succeeding month's issue. NOTE NEW CLOSING DATE.

YOU WON'T HAVE TO HIRE A VALET—TO LOOK AFTER YOUR EDISON B THIS SUMMER. HONESTLY BUILT—TO LAST YOU A LIFETIME. 54 VOLT BATTERY, 42 CELLS, $8.50,—100 VOLTS, 78 CELLS, $15.00—130 VOLTS, 102 CELLS, $19.00—150 VOLTS, 117 CELLS, $22.00, EACH IN COVERED FUMED OAK ASSEMBLED CABINET, LARGEST EDISON ELEMENTS WIRED WITH PURE SOLID (NOT PLATED) NICKEL, NON-FLOATING PERFORATED HARD RUBBER SEPARATORS, BANDS, GENUINE EDISON ELECTROLYTE (THAT'S NO LYE), WHITE SEALING OIL, CELL CONTAINERS FELT PACKED, CRATED FOR SAFE SHIPMENT. CELLS ALONE 15¢ EACH. WILLARD COLLOID, A REAL RECTIFIER, $2.00. JUMBO SIZE $3.00. TUNGAR HIVOLTAGE CHARGERS, PARTS, INSTRUCTION SHEET 50¢ ANNEALED GLASS TEST TUBES INDIVIDUALLY WRAPPED, ¾x6" 3¢, 1x8" 4¢ 1½x7" FLAT BOTTOM HEAVY TUBE 7¢. 99% PURE SOFT DRAWN SOLID (NOT PLATED) NO. 20 NICKEL WIRE FOR CONNECTORS 1½¢ FOOT PREPAID. PERFORATED HARD RUBBER SEPARATORS ½¢. GENUINE EDISON ELECTROLYTE (THAT'S NO LYE) 5 LB CAN $1.50. PURE POTASH 80¢ LB. TYPE A EDISON ELEMENTS 6¢ PAIR (SPECIALLY TREATED TO MAKE DRILLING EASY). DRILLED 7¢. WIRED WITH SOLID PURE NICKEL 10¢ PAIR. TYPE G DRILLED ELEMENTS 4¢ PAIR, 2 POSITIVES 1 NEGATIVE 5¢. 3 POSITIVES, 2 NEGATIVES DRILLED AND CUT IN HICAPACITY UNIT READY TO WIRE 10¢. HICAPACITY CELL PARTS 17¢, SAME READY TO WIRE 19¢, WIRED 24¢, INCLUDING SOLUTION. GREAT FOR TRANSMITTERS, POWER AMPLIFIERS, SUPERS. SUPERCELL OF 6 A ELEMENTS IN 1½"x7" HEAVY CONTAINER, EVERYTHING READY TO WIRE 30¢, WIRED 35¢, SOLUTION INCLUDED. 3000 MILLIAMP HOUR CAPACITY. A & G CELL SAMPLES 25¢, SUPERCELL 35¢. FRANK MURPHY, RADIO 8ML, 4837 ROCKWOOD ROAD, CLEVELAND, OHIO.

FIRST WARM DAY TACKLE THAT AERIAL AND PUT A LITTLE MORE PEP IN HER. OHIO BRASS CO. PORCELAIN ANTENNA INSULATORS ABSOLUTELY THE BEST. DON'T LET EM SELL YOU SOMETHING "JUST AS GOOD". 5" 75¢, 10" (GLAZED ALL OVER) $1.50 PREPAID. CORONA SHIELD $1.00 ATTACHED. CORONA BUSHINGS WHEN REQUESTED. SNAPPY SHIPMENT ON OBs AND ANTENNA WIRE. A DULL DINGY AERIAL SAPS YOUR SET OF HALF ITS PEP. NO. 12 SOLID COPPER ENAMELED AERIAL WIRE STAYS NEW, GLISTENS BRIGHT AND SHINY IN THE SUN. LOWEST HIFREQUENCY RESISTANCE, 1¢ FOOT PREPAID TO YOUR STATION. RADIO 8ML, 4837 ROCKWOOD ROAD, CLEVELAND, OHIO.

TRANSMITTER—10 watt, phone and I.C.W., Kenotron Rectifiers, Panel mounted with steel frame. Commercial style. A fine set. Price complete with 4 new tubes, $115.00. Clayton R. Gerst, 2974 W. 25th st., Cleveland, O.

FOR SALE—Half Kilowatt Spark Transmitter, Packard Transformer, Molded Condenser, Enclosed Benwood Gap, Large O. T. $20. Clifford Mauger, 100 South Tenth, Reading, Pa.

FOR SALE—Monodyne $8.50 Crystal Portable $4.00. Duck Bros. Receiving Coupler, $4.00. National Head Set 2200. ohm. Phones $3.00. George Proscher, 567 Amsterdam Ave., New York City.

5BX GOING TO California, have to sell Westinghouse 500 volt 100 watt Motor-generator, guaranteed OK. Cost $85 month ago, sell for $50. Watson, 2500 Maple Ave., Dallas, Texas.

FOR SALE—Grebe CR-3 and RORD $100. 20 Watt transmitter at 9CSI $125.00 complete. M. L. Monson, Grafton, N. Dak.

EMPIRE CLOTH FOR INSULATING THAT NEW TRANSFORMER. ONE SQUARE YARD $2.00 HALF $1.00, QUARTER 60¢, FOURTH EDITION CITIZENS RADIO CALL BOOK JUST OFF THE PRESS, WRITE FOR YOUR COPY, PRICE 50¢ PLUS POSTAGE ONE POUND. ARE YOU USING HEISING IN YOUR FONE SET? WELL YOU NEED A REAL HE CONSTANT CURRENT CHOKE, GET AN ACME DOUBLE COIL 1½ HENRY 500 MILLI $8.00 MAGNET WIRE No. 10 DCC 55¢ LB., No. 12 DCC 60c LB. No. 15 DCC 65c LB. AS MUCH OR AS LITTLE AS YOU WANT. EQUIP YOURSELF WITH THE "BEST" ANTENNA, PUT UP SOME No. 12 SOLID COPPER ENAMELED SELLS FOR 1¢ PER FOOT, AND HAVE DONE WITH THE HIGH RESISTANCE RADIATION SYSTEM. ENAMELED WIRE AND OHIO BRASS INSULATORS WILL PUT YOU IN A CLASS BY YOURSELF. OBS SELL 5" AT 75¢ AND 10" AT $1.50. ALUMINUM???????? HECK YES, LOTS OF IT. SAYS 5AJT—BY USING YOUR CHEMICALLY PURE ALUMINUM AND SHEET LEAD, MY NOTE ON CW SOUNDS LIKE B BATTERY PLATE SUPPLY. ALUMINUM SELLS FOR 90¢ PER SQUARE FOOT, SHEET LEAD 30¢ PER LB., 2½ LBS. TO SQUARE FOOT. GIVE US A TRIAL ORDER, WE GIVE REAL SERVICE. THE ONLY HAM STORE IN THE FIFTH DISTRICT. NEW PRICE LIST JUST OUT. GET YOURS BY DROPPING CARD SHOWING YOUR QRA. FORT WORTH RADIO SUPPLY CO., 104 EAST 10TH ST., FORT WORTH, TEXAS.

5VM's 1000 VOLT, 400 watt Esco MG, compound, four bearing, double commutator, ring oiled, 60 cycle, 110-220 single phase; machine in perfect condition, used very little, $125. Want three UV1716s. Emry Stuedle, Okla. University, Norman, Okla.

SELL—One Sacoclad, Two UV1714 transformers. Three fifty each. Carl Elsaser, Boonville, N. Y.

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200 DOWN—Calibrate that wavemeter at home, easy. We will tell you how to use the new projection method for 10¢. No calculation or guess. Moore, 902 North Fourth Avenue, Tucson, Arizona.

BARGAIN—Every Ham needs a set of Stevens Spintite Radio Wrenches. Set of three popular sizes sent postpaid on receipt of money order for 75¢ Dollar value. Radio 9DWS 805 S. 2nd St., Champaign, Illinois.

FOR SALE—Esco 1000 volt 250 watt motor generator practically new, $75. C. C. Brown, Redding, Calif.

FOR SALE—Federal Hand Microphone, $5.00; 5-watt Plate and Filament transformer, $10.00; UP-1719 grid leaks @ .60, UP-1016 Power Transformer, $25.00; UV-216 Kenotron (New) $6.00. Arthur Walser, Chesaning, Mich.

SELL—Radiolas RC, AR, and RT. New condition. Quick sale $250.00. Edward Cooper, Jr., Bramwell, West Va.

FRENCH TUBES—the original, one of the best detectors and amplifiers known. Original price, $12.50; our price, $4.50; Three, $12.25. Petsto Radio Laboratories, Wauwatosa, Wisconsin.

RENT ME Your Spark Set, Send Terms to 9BNT.

FOR SALE—UT1367 Magnetic Modulator, $11.25 Jewell Thermocouple Ammeter 0-10, $7.25. R. Russell, Bath Ave., Niagara Falls.

SELL— G. E. MERCURY Arc Charger $12, 3 new amplifier tubes, $3.75, Baldwins $9. C. McDermott, Bellevue, Iowa.

FOR SALE—One Grebe CR13 new, $67.50. Maurice E. Kimmel, DuQuoin, Ill.

PRACTICALLY new Esco Motor-Generator two bearing type. Hundred ten volt sixty cycle motor, five hundred volt hundred fifty watt direct current generator. Must sell because fifty cycle suuply here. Fifty dollars. The Radio Shop, Fifteen Fifth Street, Redlands, California.

ATTENTION HAMS—Have you spent hours trying to cut peep and meter holes in panel? I have a tool that drills them one to five inches in diameter as easily as quarter inch one. Only $2.50 postpaid. Homer Malcomb, Whitewater, Wisc.

WANTED—Used Hall relay and recorder. Ben Herr, Lebanon, Indiana.

FOR SALE—Regenerative Receiving Set Complete with Batteries, Fones and Radiotron. 2000 mile DX. $25.00., Also Radio Corp. Variable Condenser, $3.50; Atwater Kent Variometer, $3.50; UV-712 Transformer, $4.50; Four slightly used UV-201, $2.75; Amplitone Loud Speaker $2.50; All good condition, 9DEU. Adolph Will, Macon, Mo.

30 HENRY chokes capacity .75 amperes, $10; R.C.A. UL1008 Inductances, $6.50; PT537 Rheostat, $5; New 10 Ampere Mercury Arc Tube, $14; New Tungar Tube and Socket, $5; Will sell or trade. 3PZ.

VOLTMETER WANTED—0-10 AC. Homcharger for sale, $8.50. Will swop charger for meter, write 9BTY.

WANTED—25 cycle ¼ K.W. Spark Transformer, Donald Fowler, 152 Forest Street, Chatham, Ontario.

FOR SALE—Station 5ACM complete, transmitter and receiver. $125.00 cash. Write for particulars. Arthur Hill, Hill's Studio, Anniston, Ala.

100 OR MORE D.C. Gen. Electric Generators—Guaranteed output 375 volts. $7.50 each, Prepaid. John Matthews, Newton, Iowa.

UNCLAIMED LETTERS

Letters have been returned to this desk after being sent to the following members. Please send in a postcard giving your correct and complete address, INCLUDING THE STREET NUMBER.

Hugo C. Gibson, DeVer C. Warner, Duncan Merriwether, R. S. Rose, George Turner, E. L. Dye, A. A. Haagensen, E. R. Bateman, Stillman Shaw, Jack Paddon, Howard I. Morris (?), J. Edward Page, F. C. Van der Voort, R. W. Decker,

In addition a number of letters cannot be answered because the writer signed only a radio call which has recently been re-assigned.

Technical Editor.

WANTED—Omnigraph, Must be cheap. Bernard Taylor, Thornton, Tex.

NEW GREBE APPARATUS for sale or trade for C. W. Apparatus, CR-6—list $200.00 for $125.00, CR-9—list $130.00 for $80.00, CR-8—list $80.00 for $60.00, RORN—list $60.00 for $40.00, FINCH Automatic Relay and Recorder—list $250.00 for $125.00. Pick yours out and shoot me a check. M. G. Watson, 1521 Elm St., Dallas, Texas.

BARGAINS—Acme 300 watt power transformer $20; No. 64 Jewell 0-5 radiation ammeter $10; No. 74 Jewell 0-15 A. C. Voltmeter $6.50; New Omnigraph No. 2 $15; Two Stage A. F. Amplifier-in-cabinet $20; two 5 watters $12; Hawkins Electrical Guides $5; any size H.C. Coils 25% off list. Charles Johnson, Pullman, Wash.

BARGAIN—Jewell 0-10 AC Voltmeter, Never used, $7.00. N. Klein, 1773 Carlyon Rd., Cleveland, Ohio.

FOR SALE—Navy Type Detector Cabinet, $7.00; Chopper Motor, $5.00; Paragon 10-R Radio Frequency, $30.00; Complete 1KW Spark, $25.00. All practically new. Terms 1/3 down, balance C.O.D. 8AVJ.

SEND AN Acknowledgement Card. 65¢ per 100, with call letters in red $1.00 per 100; on government stamped cards add $1.15. Send money order today. Satisfaction guaranteed. Samples on request. The Wirless Acknowledgment Card Co., 325 Sixth Ave., McKeesport, Pa., Dept. 46.

FOR SALE BARGAIN—New 5 Watt Broadcasting Station including motor Generator, Tubes and Microphone . Write for particulars. Webster Electric Company, Racine, Wis.

WANTED—Vibroplex, have Homcharger, new, Remler Variometer, Mitchell Variocoupler, Bunnell Sounder. Royal S. Daggett, Vineyard Haven, Mass.

STATION CARDS—Your call in red. Space for transmitter, receiver, remarks, etc. First hundred, $1.00, each additional hundred, $0.65. .Also personal stationery with league emblem for members. Low prices, quick service. Burdette H. Buckingham, 195 West Eleventh Ave., Columbus, O.

WANTED—Copies of QST from 1917 to 1921, inclusive. State month and price, Robert Browne, 326 Broadway, N. Y. C. Care of RCA.

FOR SALE—deForest D7A Reflex Receiver—with tubes—One hundred dollars. C. G. Jewett, 417 Franklin, Keokuk, Iowa.

WANTED—Edison Sixteen Volt, 450 A. H. Battery. H. L. Hackley, Box 248, Truckee, California.

STATION CARDS—Printed on Government stamped postals, with large red call letters, $1.50 up. Send for samples. Printed by 9DOG, Geo. D. Louden Printing Co., Champaign, Ill.

9AE's DX Transmitter For Sale. Heard in every state and New Zealand. Sell cheap. For dope write R. N. Jones, 209 Hyland Ave., Ames, Iowa.

WANTED—Motor-Generator 500 volts 100 watts, Direct current motor. What have you? R. E. Ladendorff, Burt, Iowa.

SUPER-Heterodyne—Build your own—The best circuit. Four Air Core transformers (no iron), baseboard and panel layouts, and circuit, price $25.00. Also complete parts, including drilled and engraved panel, solder—everything except cabinet $85.00. 2LO on a loop. Agents wanted. Philadelphia School of Wireless Tel. 1533 Pine Street, Philadelphia, Pa. Est. 1911.

DUBILIER MICA Condensers, Limited Quantity, Type C.A.3, .004, 8500 volts. Excellent for C.W. and spark. Price $3.50 prepaid. F. A. Alexander, 62 West 14th St., New York, N. Y.

WILL BUY MG SET OF high voltage if its guaranteed and extra cheap. Describe. Summers coming. Watson, 2500 Maple Ave., Dallas, Texas.

MORE APPLAUSE, Please! On Applause Cards at 65¢ per 100 postpaid. Send money order at once. Money refunded if not satisfactory. Samples on request. The Wireless Acknowledgment Card Co., Dept. 47, 325 Sixth Ave., McKeesport, Pa.

7 No. 201 and 3 No. 200 @ $2.50 each; 1 No. 202 @ $6.50; 1 set of Victor wireless records @ $3.00; 1 Tuska C.W. Inductance $3.00; 2 No. 1714 transformers @ $3.00 each; 2 Tuska variometers with knob dial and brackets $5.50; 2 moulded veriometers $5.00; Variocoupler @ $1.00; 2 No. 712 transformers @ $4.00 each; 1 Baldwin headset cord and plug type "C" @ $8.50; 1Baldwin loud speaker Westinghouse Vocerola type @ $12.00. R. A. Gilman, Norris, Montana.

ORS A.R.R.L. is certificate proficiency. List our students holding this appointment also records rapid progress, quick success free. Dodge Radio Shortkut, Dept. S.C. Mamaroneck, N. Y.

OMNIGRAPH Wanted—Philip Brown, 2648 S. Sheridan Street, Philadelphia, Penna.

BARGAIN—Grebe CR9 with 3 Western Electric tubes $95. Western Electric 10-D speaker, $33. Schuck, 1411 Avenue A., New York City.

SELL—Two circuit tuner and two step amplifier. Formica panels and cabinets. 2 pairs headphones. $50. Great DX records. Write. 1-CTP.

SACRIFICE—½ KW 500 cycle alternator $65; ¼ KW alternator $25; Radio corp 750 watt trans. $22.50; new UV203's $20; 4 WE peanut Tubes $4; Colt .45 Calibre Army automatic $20; 1500V Generators $35; other CW apparatus—Edward Page, Baldwinsville, N. Y.—8AQO.

MUST SELL COMPLETE 20 watt CW and fone set immediately. This is a fine outfit and will sell cheap. Write John McGregor, Pontiac, Illinois.

WESTINGHOUSE—T. F. transmitter fone and C.W. with 4 five watt tubes, motor generator and key, brand new never been used. $150. J. C. Gill, 342 West Main St., Galion, Ohio.

BARGAIN—Single circuit receiver with 2 stages A.F., double circuit jacks in oak cabinet $40; 2 Faradon UC 490, 1MFD 1750 volt filter condensers $2 each; Acme 1½ henry choke 500 MA double coil $6.50; Murdock .001 variable condensers $3.50; three coil H.C. mounting $3.50; Chelsea .0005 variable condensers $3.25. Paul Schumacher, 222 Harrison St., Pullman, Wash.

FOR SALE—Western Electric 7A amplifier, loud speaker outfit with 2A current supply set for running on AC. No batteries required. Complete with tubes,

good condition $125. I. G. Wilson, 91 Remsen Street, Brooklyn, N. Y.

SELL—In A-1 condition, 5 watt tube, $5.00; Jewell voltmeter 0-15, $4.50; Wimco inductance, $6.00; Cotocoil condenser $3.00. Irwin Johnson, 831 Rittenhouse St., Washington, D. C.

HERE YA ARE—DX Receiver, one tube, all districts in ten minutes, $20.00. 2 Willard Storage "B"s, $6.00. Slightly used. Snap it up. Melbourne Renken, Cole Camp, Mo.

FOR SALE—New Giblin Remler 1250-1500 coils $2.50 each; 1double coil mounting $1.50; all for $6.00; 3 new 202's $5.00 each; 2 Radio Corp 5 watt rheostats $2.00 each; 1 Westwyre .001 vernier variable condenser used $3.25; 1 Horne .001 variable condenser new $3.00. Thomas Henley, Jr., Paris, Texas.

SELL—"Esco" 6-8V 500V dynamotor, 9DPN, Chicago.

FOR SALE—Amrad three circuit regenerative receiver and detector 2 step with tubes, $68. N. C. Jones, Billerica, Mass.

SELL-PARAGON RA10. Almost new. $45. Need the money. William Loeffler, 51 Woodland St., Lawrence, Mass.

INVENTORY SALE of One Tube Sets. Regular Value $18.75. OUR PRICE $6.90. Limited Number on hand. No Circulars. Send Cash or Money Order. William Q. Greene, 25 Third Ave., New York City.

FOR SALE—Stahl sync. rectifier, used four months excellent condition. First Forty Dollars. Hise 9CSY.

FOR SALE—1KW United open core transformer, 2 Dubilier Condensers and one Grebe synchronous gap. C. J. Goette, 10938-115th St., Woodhaven, L. I.

BRAND NEW—¼ to ½ KW 500 Cycle Excited Alternators $18.00, with Transformer, state your voltage for CW $24.00; ¼ KW CN1105 Quenched Transmitter with Alternator $32.50; Weston Thermos, Flush 0-4 amp $7.25; 53 ft. Portable Mast $20.00. Prompt Shipment. George Eaton, 1915 South Twelfth, Philadelphia.

50 WATT WESTERN ELECTRIC Tubes $28.00; 250 Watt Western Electric in stock; 50 Watt 203-A R. C. A. Tubes, $25.00; R. C. A. Radiation Meters (0-2.5—0-5.0), $3.25; Filter Condensers R. C. A. .5 Mfd., $1.00; Faradon Antenna Series Condensers, $2.50; Mercury Variable R.C.A. Transmitting Condensers, $4.00; Crocker-Wheeler ½ KW. 500 Cycle Generator and Exciter Generator with Gas Engine Drive For Sale with or without Gas Engine; ¼ KW. 110 D.C. 500 Cycle Motor Generator, $30.00; A large collection of 500 Cycle and C.W. Transmitting Material For Sale cheap, R.C.A. and other standard makes. Troy Radio Co., 1258 St. John's Place, Brooklyn, N. Y., Decatur 6139-J.

EDISON TYPE A Elements 5¢ per pair. First Grade only. No. 20 Grade "A" pure nickel wire, 1¢ per foot. Perforated Separators, ½¢ each. ¾x6" Flat Bottom Container 3¢. 84 Cell knocked down Rack, ready to assemble $1.95. Holes are drilled to take ¾x6" container. Dry Caustic Potash in sticks 80¢ per lb. While they last, brand new French make 6 volt 60 ampere lead storage batteries in transparent Pyraline cells, cannot crack or chip $5.75 each. Money back if not satisfied. Shipping weight 30 lbs. J. Zied, 530 Callowhill St., Philadelphia, Pa.

20 WATT TRANSMITTER complete, Acme transformer, 3 meters, 4 tubes, all district DX-$90. 8BOB.

KENNEDY UNIVERSAL No. 110 with two step amplifier. Practically new. Cost $370. First $175 cash takes this bargain. George Momberg, Latonia, Ky.

FOR SALE—Motor Generator Set. Emerson-500 volt -200 watt-new. First Money Order for $60.00 takes it. Guaranteed. 9CEE.

WANTED—Two new UV-204-A tubes (9CZP)

FOR THAT LOW LOSS short wave tuner. No. 12 Double Cotton covered Copper Wire, $1.20 per 100 feet prepaid. 8ML, Cleveland, O.

FOR SALE—10 Watt set for Key or Broadcasting. For particulars write to A. E. Schilling, 106 Elm St., Kalamazoo, Mich. Will send photo on request. Station W.L.A.Q.

FOR SALE—"DX" Radio Instrument Co. 6-tube amplifier, 3 r.f., det., 2 a.f., with plug-in transformers 170-450 meters, can be easily utilized in superhet by connecting in other transformers; value $125, condition like new, $75. Hard Moorhead amplifier tubes, best for above set, practically unused, $3 each. SCR-68 sparkcoil transmitter, $18. SCR-54 portable crystal receiver, $20. Reliance laboratory model DC milliammeter 0-10 and 0-100, $5. Weston 0-100 flush DC milliammeter, $4. Tuska Type E three-circuit regenerator, $20. Original 1922 Reinartz tuner photographed QST March 1922, $15. SE-95A navy long-wave tuner, $200. Two Cotocoil R.F. transformer-reactors in tandem, $8. K. B. Warner, care QST.

NOW FOR THE REAL THING—Genuine Edison B Batteries, in Nickelled Steel Containers, type W, Twin-Cell Units, used by the Navy, in first class condition, and offered at amateur prices: $.50 per cell, in dozen lots. Tray supplied for holding 44 cells, and also handsome steel boxes for holding complete batteries. Sample twin-cell, prepaid, $1.35. This is the chance of a lifetime. A. R. Spartana, 615 N. Washington St., Baltimore, Md.

SELL—R.C.A. Power transformer UP-1916. New, $24.00 cash. 4SE.

FEW NEW W.E. fifty watters, $25; Airplane 30-350 volts D.C. dynamotor, $12. 2BYJ.

FOR SALE—One 1½ K.W. 60 cycle, Single phase General Electric transformer: 1040/2080 to 115/230 Volts. Oil cooled, $10.00 at Chicago. M.. Wesely, 7142 Rhodes Avenue, Chicago, Illinois.

RADIO CORPORATION transmitting apparatus at rock bottom prices. UC-489 1750 volts filter condensers, $1.00; 6000 volts, 4 amps, .002 condensers, $4.50; 1831 4000 volts 5 amp variable antenna condensers $5.50; 1015 7500 volts .0003, .0004, .0005 grid or series condensers $4.00; UT-1654 large filter reactors $12.00; 1653 small filter reactors $8.00; PX-1638 chopper wheels $4.00; Everything new in original packing. David Talley 2PF, 1435 East 19th St., Brooklyn, N. Y.

SELL—GREBE CR8. Consistent range both coasts, nightly. A real buy. Fifty fish, prepaid. 9CIN.

INDUCTANCES—25 turn pancake inductance for Reinartz Balanced Circuit, $8.00; 2 and 3 coil inductances $15.00 and $20.00 respectively. Inductances a specialty. Write us your wants. 8NX.

FOR SALE—Paragon RA 10. Perfect condition, $45. Hackensack Radio Club, Box 194, Hackensack, New Jersey.

GREBE CR-13 for sale, new perfect condition, $62. All letters answered. N. S. Stackpole, 139 Pratt St., Providence, R. I.

SELL—Four new VT-2 five watt power tubes $5.00 each cash. 4SE.

PURE SHEET Aluminum and Lead 1/32" 75¢ Square foot. 9DVK.

NEW RADIO STUFF—Jewell Meters—0-5 TC-Ammeter $10.50; 0-500 Milliammeter $6; New "S" Tubes pair $18.00; Used "S" Tubes pair $12.00. What have you to trade? Want Omnigraph. James R. Curtis, 1109 Eighth Avenue, Fort Worth, Texas.

SELL—One new DeForest reflex receiver at $45. Morris Decker, Baldwinsville, N. Y.

UV73 Pliabletron 5 to 1000 watts $8. Page 52 March issue. 8ML sells em. Pump Free.

SELL—RC Inductance, $7.00; UV203 Socket, $1.00; UC1831 transmitting condenser, $4.50; Two Acme 150 watt filament heaters, $10.00 each; Condensers, UC1015, $3.00; UC1014, $1.50. Woolfries, 304 Welch Ave., Ames, Iowa.

MAGNAVOX R3—Latest nationally advertised reproducers; concert modulator. List $35. Introductory $25. The factory sealed carton is your guarantee. Radio Central, Dept. Q, Abilene, Kansas.

LOWEST PRICES ON STANDARD RECEIVERS, 20% DISCOUNT. THOMAS RADIO SUPPLY CO., MUNCIE, IND.

"KNOCK 'EM DEAD"! GET A SINK! ADVANCE SYNCHRONOUS RECTIFIERS $40. GREBE "13" 'S $80. WRITE FOR DESCRIPTION. ADDRESS ABOVE.

PURE SHEET Aluminum and Lead 1/16" 75¢ Square foot, 9DVK.

FOR SALE—Acme Two hundred watt Transformer, Ten Dollars; Two Kenotrons-Two sixteen, Three Dollars. H. Zirschky, Burbank, Okla.

TRANSMITTING—Grid leaks, 5W. RCA $1.10. RCA Filter Reactors UP1626, 5W. size, regular 1250, special price, $6.00. Philadelphia Wireless Sales Corp., 1533 Pine St., Phila, Pa.

FOREIGN amateurs, KDKA and WGY pound in on low waves. Blueprint and complete data for One Dollar. Low loss condensers, eleven plate, three dollars, twenty-three plate three fifty. Send stamp for complete list. Superior Coil Company, Harwichport, Mass.

FOR SALE—2 Grebe RORN $40.00 each; Grebe CR-3 $40.00; Grebe RORD $50.00; Amrad Variometer set with 2 step $50.00; single circuit with 1 step $25.00; Acme 75 watt power transformer $11.00; complete 1/12 KW Spark $25.00; Thorophone $35.00; Michigan Variocouplers $3.00 each; 0-5 Jewell R.F. ammeter, large type, $9.00; Single circuit 2 step complete with Magnavox, etc., $60.00; Reinartz tuner $15.00; Model C Superheterodyne complete with storage "B," Loud Speaker, etc, $300.00; write for list of new and used parts and apparatus. Electrical Specialty Company, Valparaiso, Indiana 9DVK.

HAMS ATTENTION—Acme C.W. Inductance at Cost. Only $1.95. 30 turns No. 12 Wire on 5" Slotted tube. Studs on every turn. Hurry. 9-BNC. Robt. Adams, Anthony St., Glen Ellyn, Ill.

PURE SHEET Aluminum and Lead 1/16" 75¢ Square foot. 9DVK.

PURE DC FOR THE PLATES—New 1500 volt 500 watt General Electric dynamotors operating from 24 volts. $45. Holtzer-Cabot 500 volt. .07 ampere for 12 volts. $22. General Electric 350 volt .143 ampere for 12 volts with filters $18. Either of above for belt drive $3. additional. When driven will also develop current for filaments, battery charging, etc. General Electric fone, cw, icw transmitters originally costing $350. new—complete with two tubes, dynamotor, spares, etc. $75. Operates from 12 volts. 500 cycle generators with and without motors. GE 203A $28. 250 watters $85. 1000 watts $150. Henry Kienzle, 501 East 84 Street, New York.

SELL—Radio Corporation 750 watt Transformer, $25.00; Grebe CR2, $25.00; Radio Corporation Mercury Condenser, $4.50; Radio Corporation 0-5 Hot Wire Ammeter, $5.00. 2WZ.

WILL TRADE FOR KENNEDY Type 110 Universal Type 525 Two Stage Amplifier, must be in perfect condition, $100.00 cash, three circuit 150-600 meters and single circuit 150-3000 meters regenerative sets each with two stage amplifier, guaranteed perfect condition, cost $260.00. Joseph Schindler, 116 S. Rebecca Ave., Scranton, Penna.

DON'T BUY MUD for that short wave set. Radio Corp Porcelain Sockets, seventy-five cents; Freeman Porcelain Sockets, forty cents. Superior Coil Company, Harwichport, Mass.

LOOK FELLOWS—500 volt 100 watt Robbins-Meyers motor-generator $50.00. 20 watt C.W.—fone complete set of meters with 2 tubes, $100.00. 750 volt 250 watt generator $25.00. Two stage power amplifier $20.00. 10 watt C.W.—fone complete less tubes $75.00. 110 volt 100 watt generator $10.00. 15 dial omnigraph. Write for further description. H. S. Brooks, 151 W. First St., Fulton, N. Y.

EDGEWISE—Wound Copper Ribbon 1/8 inch wide 6 inch diameter 15¢ turn, 7½ inch diameter 17¢ turn. Remler Giblin Coils mounted 100-150-200-300-400-500-750 1000 turns half price. Genuine Silicon Transformer steel cut to order 25¢ pound 10 lb. and over, 4 cubic inches to pound. Chemically pure Aluminum 1/8 inch 80 cents. ¼ inch $1.60 postage extra. Geo. Schulz, Calumet, Mich.

KNOCKED DOWN—50-150 Meter receivers, detector and one stage. Panel drilled ready to assemble and wire. Best of parts. Price $20. Superior Coil Company, Harwichport, Mass.

NEW TUBES—Westinghouse. WR 21 Amplifiers, 4 volts. 8 Amp., Price with sockets, $2.50 each; DX. Radio Frequency Transformers and mounts $4.50 each; DeForest Unit Panel Vernier Condensers .001 and .0015 $8. each; Fixed Variable Condenser $4. Acme Choke, $2.25. McCarthy, 4412 Washington St., Roslindale, Mass.

STAHL SINKS $45.00 prepaid; G. R. Wavemeters 2% accurate 150-500 Meters $10.00, 9DVK.

AMATEURS! HAMS! NOTICE THESE PRICES ON "QSL" CARDS. 500 POSTAL SIZE CARDS PRINTED IN BLACK INK WITH LARGE RED CALL LETTERS, $4.00. A.R.R.L. CUT USED IF WANTED BY MEMBER. TWO COLOR APPLAUSE CARDS FOR BCLS AT THIS PRICE ALSO. NOT MORE THAN TEN LINES OF PRINTING. THIS RATE ON 500 ONLY. CASH WITH ORDER. A.R.R.L. MEMBER CURTIS, 1109M EIGHTH AVENUE, FORT WORTH, TEXAS.

TRANSMITTER BARGAINS—75 Watt Acme Mounted Transformers $10.00; S Tubes and Sockets new each $6.00; only few, order early. Van Blaricom, Helena, Mont.

REINARTZ TESTED REINARTZ Receiver with two stage amplifier in case. Has all refinements. Parts alone cost $65.00. Will take $50.00. Have logged 3000 miles with it many times. Write for particulars. Van Blaricom, Helena, Mont.

FOR SALE—10 watt set for key or broadcasting. For particulars write A. E. Schilling, 108 Elm St., Kalamazoo, Mich. Will send photo on request.

CALLS HEARD POSTAL CARDS (for DX reports). Send $1.00 with your name, address and call letters for 100 ($1.75 for 250) printed report postal cards with large red call letters. Complete form for description of your station, etc. State if member of A.R.R.L. Cards also printed to order—prices upon application. Twenty-four hour service. Samples of our complete line of cards, rubber stamps, etc. on request. Printed by 9AVO, member A.R.R.L. Radio Print Shop, Box 582, Kokomo, Ind.

100 WATT C.W. and fone parts for sale at sacrifice. Write for list. 2COA.

HAMS—Get our samples and prices on Printed Call Cards, Radiograms, Letterheads and Envelopes. Hinds & Edgarton, Radio Printers, 19 S. Wells St., Chicago, Ill.

W.E.216A's at $6.00, U.V.199's at $3.75. R. Breunig, 2252 Roscoe St., Chicago.

SELL—UV200 $3.25. UV201A $4.50. Acme 200 watt transformer $14.00. Reinartz tuner-two coils-60-275 and 180-800 meters $12.00. Detector two stage $15.00. World 80 amp battery $8.00. Write today. 9CRK.

WHY PAY MORE—Genuine Ohio Brass 5" insulators $.50 each; all receiving tubes $4.25 each; Radio Corp. products 15% off list, all standard batteries 20% off list; goods shipped same day order received. Benson El. Co., Box 76, La Habra, Calif.

PURE SHEET ALUMINUM and Lead 1/16" 75¢ square foot, 9DVK.

SELL—One fourth horse power Westinghouse continuous duty, 110 volt A.C. motor. New. $20.00 cash. 4SE.

1-200 WATT mounted Acme plate transformer, $10.00; 1-75 watt mounted Acme filament transformer, $8.00; 1-UT-1367 Magnetic modulator, $12.00; 1-Western Electric desk microphone, $10.00; 1-UC-1831 variable transmitting condenser, $3.00; 1-UC-1014-R.C.A. grid condenser, $1.00; 1-mounted Acme 1½ Henry Choke, $2.00; 1-Grebe CR-8 new, $55.00; 1-Grebe Rork 2 step $30.00; 1-type R-3 Magnavox, $18.00;1-DeForest old time 2 filament audiotron never used, $5.00; 2-UV-201's hardly used, each, $2.50; 1-Bunnell Bug Key new, $2.00. 3KO, Paul R. Kern, 1030 N. 10th St., Reading, Pa.

A.R.R.L. MEMBERS ONLY—twelve to twenty-five per cent discount on anything in radio. Radiotron UV201-As at $4.50, five watters seven bucks. We save you money on anything. Amateur apparatus a specialty. C. R. Smith Radio Company, Port Arthur, Texas. Radio 5OC.

WILL SELL GREBE CR8 and Rork 2 stage amplifier, $90; R3 Magnavox $20; three Radio Corp No. 1417 R. F. transformers each $3.50 honeycomb coils 200 to 1500 turn at half list C301 tubes $3.50 each Atwater Kent mounted coupler $7. Will buy Omnigraph at bargain. Fred E. Dowdell, 912 N. First St., Aberdeen, South Dakota.

BARGAIN—Belt driven chopper, adjustable speed, mounted. Cost $35. Excellent condition. No leakage. Only $18. 2CRQ.

"WHILE THEY LAST"—UV 203 $20; 203A $28; 204 $85; 206 $150. Western Electric 50 watters $25. 250 watters $90. 500 cycle motor generators and transformers all sizes. General Electric 1500 volt, 500 watt generators $45. Also other apparatus. J. K. Hewitt & Co., 252 Neptune Ave., Brooklyn, N. Y. Radio 2RK-2FP.

BARGAINS for hams—10 to 50% off on all standard merchandise due to our unusual buying powers. Send us you wants and receive prices by return mail. RCA tubes $4.34; Burgess and Eveready batteries 25% off; Acme Audio and Radio transformers $3.49; Cardwell condensers 10%; Brandes superior phones $4.79; type "C" Baldwins $7.90; Paragon detector units (list $4.75) special $2.45; RCA mercury condensers (list $8.50) $5.95; Tungar rectifiers 15%; Bakelite and radion panels, Weston and Jewell meters 15%; General radio 15%; Federal apparatus 20%; Magnavox new type $26.50. Standard sets at least 15%. Immediate deliveries guaranteed. 10% deposit with order, balance C.O.D. Guarantee Radio Service Co., 3886 Third Ave., New York City.

EDISON ELEMENTS—Drilled 5¢ pair; four fifty watt Sockets $1.50 each; UP1654 reactor $10; Three .0002 glass jar condensers $2 each; ½ KW Amrad gap $8; 3000 meter coupler $8; Reinartz tuner $12; three stage AF amplifier $30; three stage RF amplifier for 199's $30; amplitone loudspeaker $8; Westinghouse 22 volt B $4; DeForest ultraudion cabinet $10; two UP 415 reactors $4 each; Double pancake inductance $8. P. E. Slade, Box 1104, Stamford, Conn.

FOR SALE—1 Paragon RB-2, $90.00; Western Electric Sub-chaser transmitter and Receiver $140.00; 10 watt transmitter, $60.00; Magnavox R-2 $40.00; Magnavox 3 stage amplifier $40.00; both $75.00. 8-RD. 15 William St., Meadville, Penna.

HAMS!—Here's a ten watt ACCW set with a gud kick. Complete, mounted on bakelite panel, in mahogany cabinet, a beauty, sell cheap, have a fifty now. Want Synchronous Rectifier. 5OC.

FOR SALE—Federal hand transmitter, $4.00; Western Electric 7-A power amp. complete $95.00; 2-UV-217 Kenotrons used little $10.00 each; New Grebe "13" $75.00; New 5 watt tubes $5.50 each; R-2 Magnavox, $30.00; all guaranteed. Arthur Walser, Chesaning, Mich.

IVORY RADIO PANEL—White pyralin ivory makes the most beautiful set of all. Guaranteed satisfactory. Any size ¼ inch thick. Three cents per square inch. Sample sent. E. P. Haltom, 614 Main Dept. T, Fort Worth, Texas.

BARGAINS—For that Storage B battery—Largest size Edison A battery Elements only 4¢ per pair. $29.50 Edison A-6, 225 amp. hour cells for only $15.00 each. Everything in first class condition. We carry a complete line of radio supplies; write us your needs. Triumph Electric Co., Inc., Sheffield, Ala.

RUBBER STAMP with large call letters 50c; Radiogram and Relay Radiogram blanks 25c per hundred, Stock Post Card 60c hundred. Send us your orders. Carolina Printing & Stamp Co., Wilmington, North Carolina.

RADIO GENERATORS—500 Volt 100 Watt $28.50 each, Battery Chargers $12.50. High Speed Motors, Motor-Generator Sets, all sizes. Motor Specialties Co., Crafton, Penna.

$12. EACH takes Ohio or Wagner 110 volt sixty cycle eighteen hundred R.P.M. motors built in ¼ H.P. frames. Can be used as power motors. Type G. Edison elements per pair 3¼¢ Highest quality 1½" x 6" test tubes $3.00 gross. Perforated hard rubber separators 1¼c. No 20 99% pure nickel wire $1.50 per hundred feet. 25% off on 4 new Acme ½ and ¼ K.W. Plate transformers. Kimley Electric Company, Inc., 2665 Main St., Buffalo, N. Y.

FREE DIRECTIONS for constructing home built Radio with two thousand mile receiving range. Send self-addressed stamped envelope. Maitland Roach, 2905 Columbia Ave., Philadelphia, Pa.

MAKE $120 WEEKLY IN SPARE TIME. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays $120 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. OZARKA, 853 Washington Blvd., Chicago.

HAMS WHO DESIRE SPEED—a moment's attention. Brother Ham whose limit was 15 words doubled his speed in One Evening. Send your Call and ask for the facts as told by himself. Dodge Radio Shortkut, Dept. SC, Mamaroneck, N. Y.

FOR SALE—Esco motorgenerator 1500 volts 600 watts with field rheostat for panel mounting brand new, never used, $200. Ten watt C.W. and fone set all complete in cabinet and panel mounted antenna ammeter, 0 to 5 plate milliammeter, 0 to 250 Jewell meters; set can be used with any D. C. source plate supply, $75. Kennedy receiver 281 @ $95; Power transformer U. P. 1016 @ $25; Magnetic modulator 1367 @ $10; Omnigraph @ $18; 3 tube sockets for 50 watters @ $1.75 each; rheostat P.T. 537 @ $5.00; Grid Chopper PX 1368 @ $4.50. No trades considered must have cash. Every article guaranteed A No. 1 condition. 8BCA.

IF YOUR Neutrodyne won't "Neut" O.K., send 10¢ for details of Kladag Coast To Coast circuit, bill of materials, etc. to change over your Neut into a set that will bring them all in from Mexico City to Tunucu, Cuba, on a loud speaker. Or send $5.00 for all extra parts, blue print, etc. you need to do this. Stamps accepted. Radio list for stamp. Super Heterodyne specifications, 10¢. Kladag Radio Laboratories, Kent, Ohio.

100 METER coil and complete data for Reinartz Circuit. Postpaid $1.50. Superior Coil Co., Harwichport, Mass.

TELEGRAPHY—Morse and Wireless—taught at home in half usual time and at trifling cost. Omnigraph Automatic Transmitter will send, on Sounder or Buzzer, unlimited messages, any speed, just as expert operator would. Adopted by U. S. Govt. and used by leading Universities, Colleges, Technical and Telegraph Schools throughout U.S. Catalog free. Omnigraph Mfg. Co., 16M Hudson St., New York.

LITZ WIRE green silk two cents per foot. Postpaid. Superior Coil Co., Harwichport, Mass.

MASTER RADIO CODE in 15 minutes. Ten word speed 3 hours. Our students made these world records. Previous Failures who tried all known methods have thanked us for License. To hesitate kills speed. To master Code our way kills hesitation; gives speed. Code instructions that instruct only $2.00. Information free. Dodge Radio Shortkut, Dept. SC, Mamaroneck, N. Y.

BUILD A REAL SUPER-HETERODYNE!
The SUPER-HETERODYNE MANUAL, by Lieut. Victor Greiff, E.E., tells you how. Just off the press. The last word in radio. It explains the fundamental principles of the Super-heterodyne in everyday, simple language and also shows you exactly how to construct your own super-heterodyne set. Drawings half-tone illustrations, blue prints and templates are furnished. Nothing is left for you to guess at. The SUPER-HETERODYNE MANUAL is only $1.50. Your money cheerfully refunded if not entirely satisfied. Sent postpaid anywhere immediately upon receipt of your check or money-order, or if you prefer, pay postman when book arrives. Order at once as first edition is limited. RECEPTRAD PRESS, Dept. A, 57 Bank Street, New York City.

I AM UNABLE to use the Grebe Transmitter which I won in the recent Transatlantic tests. This transmitter was described in the October issue of Q.S.T. and is being held at the manufacturers pending my shipping instructions. A chance to secure this De-Luxe transmitter at a bargain price. 1ANA, R. B. Bourne, Chathamport, Mass.

1 MOTOR GENERATOR Set for sale. Motor ½ h.p. repulsion single phase, 110-220 Volt. A.C. generator 800 Volt 72 Segments on Commutator; 1 1000 Volt Generator, knocked down, will furnish wire for Armature, by 8 CWL, Hertz Battery Co., 1236 E79th Street, Cleveland, O.

5 AMP. TUNGAR $20.00; UV--203 Sockets $1.50. Transmitting Grid Leak $1.00; Murdock moulded condenser sections $1.50 each, fine for CW. Hengelbrok, 624 Monroe, Newport, Kentucky.

TRADE—50 watter, used about 2 hours, want 3 or 4 5 watters, must be in good condition. What have you? Radio 9AXD.

1KR—Leon E. Hadley, 87 Orchard Street, Leominster, HERE YOU ARE BOYS—Grab it. Finest Silicon transformer steel sheets ten by twenty, cut it yourself. Ten cents per pound. Cash with order. Pay your own freight. Brody, 1965 Horton Ave., S. E., Grand Rapids, Mich.

Q R A SECTION

50c straight, with copy in following form only: CALL—NAME ADRRESS. Any other form takes regular HAM-AD rates.

1KR—Leon E. Hadley, 87 Orchard Street, Leominster, Mass.

RADIO 1XAQ, 1AEL, 10A now at Silver Lane, Connecticut, a suburb of Hartford. Operators; S. Kruse, "LQ"; F. C. Beekley, "JS"; and A. L. Budlong, "VL"; all of the A.R.R.L. Headquarters staff.

1XAS-1ZI—Harris Fahnestock, Jr., Lenox, Mass.

1ZD es 1CAK—John M. Wells, 40 Main Street, Southbridge, Mass.

1-ZT 1-PA—George E. Nothnagle, 176 Waldemere Ave., Bridgeport, Conn.

2AEY—Raymond E. Groebe, 338 El Mora Ave., Elizabeth, N. J.

2CM—Cornelius C. Vermeule, Jr., 63 Harrison St., East Orange, N. J.

2CG—Charles S. Hallock, 5710-4th Ave., Brooklyn, N. Y.

2FG—Henry C. Baarens, 278 Passaic Ave., Clifton, N. J.

3CX—Wm. R. Stewart, Jr., 3950 Parrish St., Philadelphia, Pa.

3EP—Gideon Peirce, Westmont Ave., Haddonfield, New Jersey.

Canadian 3GG—M. J. Caveney, Lat. 48, Long. 81 near TIMMINS, Northern Ontario, Canada.

4PT—A. J. Barclay, Box 1662, Tampa, Florida.

4ZD—Paul G. Watson, 830 East Park Ave., Savannah, Ga.

5KV—M. E. Eaton, Box 384, Henrietta, Texas.

"AMATEURS—Please make correction in your call books. 5OM—WALTER M. GARRARD, 1430-No. 12th Court, Birmingham, Ala.—TNX"

5UP—G. C. Coleman, 605 S. 66th St., Birmingham, Ala.

6DO—Norman A. Woodford, 440 Tenth Street, Richmond, Calif.

6ZBJ—"Y" Radio Club, 110 W. Carrillo Street, Santa Barbara, Calif.

8BVB—Edw. C. Brichta, 3393 Williams Ave., Detroit, Michigan.

8CHM—Allen Campbell, Wauseon, Ohio.

8DAN—Ann Arbor High School, Ann Arbor, Michigan.

8DMA—Vernon S. Foote, 1442 Milton St., Grand Rapids, Mich.

8DMT—A. H. Van Norden, 132 Sanford St., Glens Falls, N. Y.

8DOQ—Chas. A. Weaver, Penna. Ave., So. Huntingdon, Penna.

9CVL—Milton L. Johnson, 938 So. 4th St., Atchison, Kansas.

9DNP—Harry Herlin, RFD No. 1, Rockford, Illinois.

9EGZ—R. W. Freitag, Preble, Indiana.

9CKB—Philo H. Tucker, 722 Randolf St., Lyons, Ia.

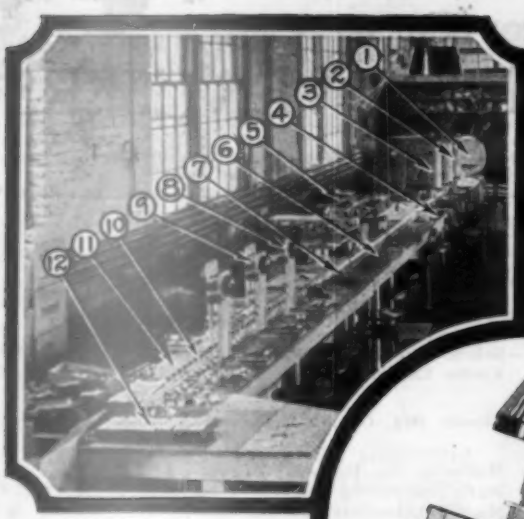
9XBE-9ZY—1627 State St., LaCrosse, Wis.

—FOR YOUR CONVENIENCE—

QST'S INDEX OF ADVERTISERS

IN THIS ISSUE

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS



View of one production line in Bradleystat assembling department. The conveyor assembly process was developed to keep up with the increasing demand for Bradleystats and Bradleyleaks. See explanation below.

View of one production line, showing operators assembling Bradleystats and packing them in cartons for shipment. All parts are fabricated in other departments. The electric furnaces are in a separate building.

How the Bradleystat is made

FOR over twenty years the Allen-Bradley Co. has made graphite disc rheostats for battery chargers and motor starters. The experience gained during these twenty years is embodied in the most perfect filament rheostat used in radio, the Bradleystat.

Today, the Universal Bradleystat, with its two columns of graphite discs under adjustable pressure, provides unequaled control for radio tubes. Its control is absolutely noiseless, stepless and of exceedingly wide range.

Bradleystats are assembled by the most modern methods and tested rigidly before they are shipped.

The illustration above depicts the assembly process that guarantees a uniform product for the radio fan.

1—Cleaning porcelains
2—Riveting terminals
3—Threading terminals
4—Inserting terminal screws
5—Disc-filling machine
6—Inserting pressure springs
7—Installing cover plates
8—Inserting adjusting knobs
9—Six testing machines
10—Conveying Bradleystats
11—Inspecting Bradleystats
12—Packing Bradleystats

Bradleyleaks follow the same process, except for the use of different discs and the installation of condensers.

Install Bradleystats in your radio set, if you want the finest filament control obtainable. Try one, and experience new delights in radio reception.

Allen-Bradley Co.
Electric Controlling Apparatus
277 Greenfield Avenue — MILWAUKEE, Wisconsin

For Sale at All Dealers

BRADLEYSTAT	$1.85
BRADLEYLEAK	1.85
CONDENSER (.00025 mf.) .	.35

THE ALLEN-BRADLEY CO. HAS BUILT GRAPHITE DISC RHEOSTATS FOR OVER TWENTY YEARS

Triple Range

Low Loss

The True Measure of Efficiency

0.1 ohm is the resistance of the

CONNECTICUT

D-10

Triple Range Variable Condenser

at a capacity of 330 micro-microfarads on a wave length of 215 meters.

This is a statement that means something.

Those who know that the losses of a condenser are in direct proportion to its resistance—

Those who have learned that measurements taken at radio frequency are much more valuable than those taken at audio frequency—

Those who can see the importance of judging the efficiency of a condenser for amateur and broadcast work on results obtained at a frequency in the immediate vicinity of that at which it is to be used—

Will see in the above the real reason why this condenser should be used by all who wish to obtain the greatest degree of signal strength and sensitivity from their receiving equipment.

Three Condensers in One

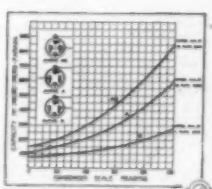
These three ranges of capacity enable it to take the place of the ordinary eleven, twenty-three and forty-three plate instruments.

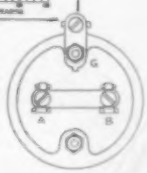
The chart tells the story—

The range indicated by Curve B—from .000075 to .000275 mfd.—approximately that of an eleven plate condenser, is secured by wiring into the circuit from posts G and B.

The range indicated by Curve A—from .0001 to .0006 mfd.—approximately that of a twenty-three plate condenser, is secured by wiring into the circuit from posts G and A.

The range indicated by Curve AB—from .00015 to .00085—approximately that of a forty-three plate condenser is secured by bussing A and B and wiring into the circuit from G and B.





FEATURES: Vernier Scale—Complete Shielding—Compact size
And all the convenience that goes with One-hole Mounting

PRICE $4.50

Complete with dial, index stud, spacing washers and buss bar.

Send for Bulletin A-104 describing this unique instrument, with information and diagrams illustrating its special applications.

CONNECTICUT TELEPHONE & ELECTRIC COMPANY
MERIDEN — RADIO DIVISION — CONNECTICUT

AMRAD

"S" TUBE RECTIFIER—
What Takes Place In The Tube

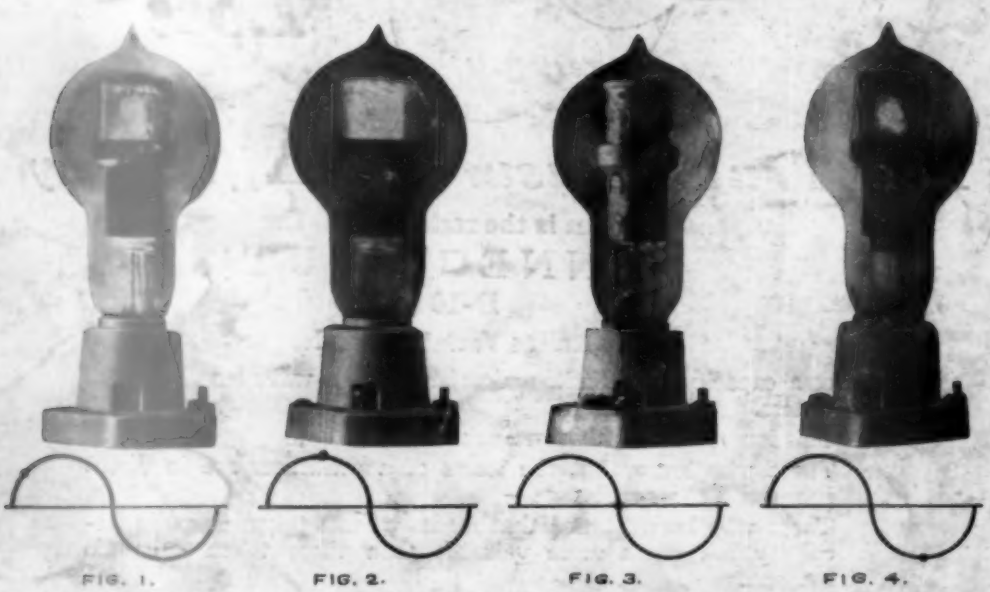


FIG. 1.
TUBE JUST BEGINNING TO CONDUCT FORWARD DIRECTION

FIG. 2.
TUBE IN FULL CONDUCTION FORWARD DIRECTION

FIG. 3.
TUBE AT 0 POTENTIAL NO CONDUCTION EITHER DIRECTION

FIG. 4.
TUBE AT REVERSE POTENTIAL SHOWING LEAKAGE CURRENT

The above Laboratory photos show what actually takes place inside the rectifying "S" Tube. The small spot on the sine curve below each view shows the point on the AC wave at which the photo was taken.

The glow in Fig 4, although apparently quite bright, is due to the negligibly small reverse current—which is less than 3 milli-amperes irrespective of the voltage and value of the forward current.

The "S" Tube used was the standard AMRAD No. 4000, excepting only that a specially constructed cathode of gauze was utilized to permit photographs being taken. A small amount of neon was added to the helium within the tube to give a brilliant red glow. A panchromatic film, sensitive to red light, was used to record the discharge image, and a specially designed shutter running at synchronous speed with the AC supply, served to catch the discharge at the desired points of the cycle.

IDEAL FOR AMATEURS

"S" Tubes find ready application in radio transmitting circuits, in charging Storage 'B" Batteries, and wherever DC is desired under conditions requiring dependable performance. The "S" Tube has no filament to burn out.

Write for descriptive Bulletin J-2

AMERICAN RADIO AND RESEARCH CORPORATION

205 College Ave., Medford Hillside, Mass.

AMRAD Dealers in Principal Cities and Towns